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November 1997

EPA Superfund Record of Decision Amendment:

Auburn Road Landfill, Londonderry, NH 12/19/1996

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
JOHN F. KENNEDY FEDERAL BUILDING
BOSTON, MASSACHUSETTS 02203-0001

DECLARATION FOR THE AMENDED RECORD OF DECISION

Auburn Road Landfill
Londonderry, New Hampshire

STATEMENT OF PURPOSE

This Decision Document amends the selected remedial action for the Auburn Road Landfill Superfund Site in Londonderry, New Hampshire, as outlined in the September 29, 1989 Record of Decision, and is developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), the National Oil and Hazardous Substances Contingency Plan (NCP), and 40 CFR Part 300 et seq., as amended. The Region I Administrator has been delegated the authority to approve this Record of Decision (ROD)

The State of New Hampshire concurs with the selected remedy

STATEMENT OF BASIS

This decision is based on the administrative record which has been developed in accordance with Section 113 (k) of CERCLA and which is available for public review at the Leach Public Library in Londonderry, New Hampshire and at the Region I Waste Management Division Records Center at 90 Canal Street, Boston, Massachusetts. The Administrative Record Index (Appendix F to the ROD) identifies the items which comprise the Administrative Record upon which the selection of the remedial action is based.

ASSESSMENT OF THE SITE

Hazardous substances have been released, or there is a substantial threat of release, into the environment. Response actions are necessary to protect public health, welfare, or the environment. Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to the public health or welfare or to the environment.

DESCRIPTION OF THE SELECTED REMEDY

This Decision Document amends a portion of EPA's 1989 Record of Decision. The 1989 ROD selected ground water pump and treat to restore ground water at the site This amendment is based on information developed since 1989 that shows that the majority of the contaminants are below the 1989 cleanup levels and those that remain will attain cleanup levels within a reasonable

reasonable time frame. The selected remedy for the Auburn Road Landfill Superfund Site will utilize natural attenuation of contaminants in ground water to obtain a comprehensive remedy.

The management of migration remedial measures include:

- the restoration of ground water through natural attenuation;
- the development and implementation of a revised ground water, surface water, sediment and air sampling program;
- the establishment of a Groundwater Management Zone, within which ground water will be restored;
- the establishment of institutional controls to notify and prevent residents from using contaminated ground water in the overburden and bedrock aquifers;
- the continued maintenance of the landfill caps and drainage system to restrict ground water movement through the disposal areas to the greatest degree possible; and
- a review of site conditions every five years.

DECLARATION

The selected remedy is protective of human health and the environment, attains Federal and State requirements that are applicable or relevant and appropriate for this remedial action, and is cost-effective. The comprehensive remedy for the site, including the capping of the landfills and the drainage improvements completed under the 1989 Record of Decision, satisfies the statutory preference for remedies that utilize treatment as a principal element to reduce the toxicity, mobility, or volume of hazardous substances. In addition, this remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

As this remedy will result in hazardous substances remaining on-site above health based levels, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

12/19/96
Date

Linda M. Murphy
Linda M. Murphy
Director
Office of Site Remediation & Restoration

AMENDED
RECORD OF DECISION

For the
AUBURN ROAD LANDFILL

LONDONDERRY,
NEW HAMPSHIRE

December 19, 1996

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AUBURN ROAD LANDFILL SUPERFUND SITE
AMENDED RECORD OF DECISION

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AUBURN ROAD LANDFILL
AMENDED RECORD OF DECISION SUMMARY
December 19, 1996

I. SITE NAME, LOCATION, RATIONALE FOR AMENDMENT & SITE DESCRIPTION

SITE NAME: Auburn Road Landfill.

SITE LOCATION: Town of Londonderry, Rockingham County, New Hampshire.

RATIONALE FOR AMENDMENT: The 1989 Record of Decision (ROD) directed the construction of a pump and treat facility to recover and treat ground water contaminated with Volatile Organic Compounds (VOCs). Natural attenuation since 1989 has reduced the concentration of VOCs to below cleanup levels set in that ROD, except in one well that directly abuts the landfilled area.

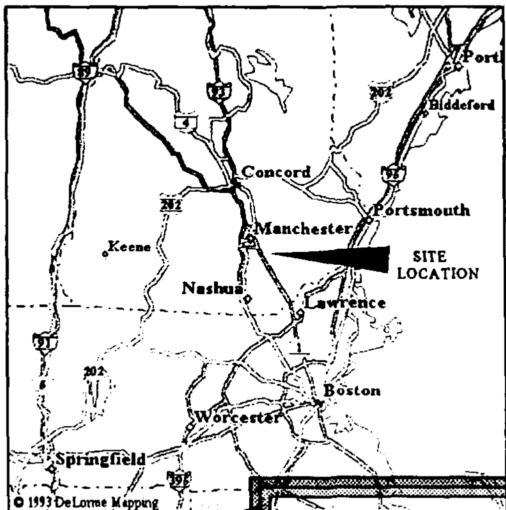
The 1989 ROD is being amended by this document to reflect the changed conditions at the Site. The contamination that remains is ground water contaminated above cleanup levels with arsenic. The landfilled areas were capped in 1994, greatly reducing the infiltration of water through contaminated areas. Ground water modeling has demonstrated that the cleanup levels for arsenic will be attained outside the landfilled areas five years after capping the landfilled areas. In addition, cleanup levels for VOCs, including the one well directly adjacent to the landfill, will be attained.

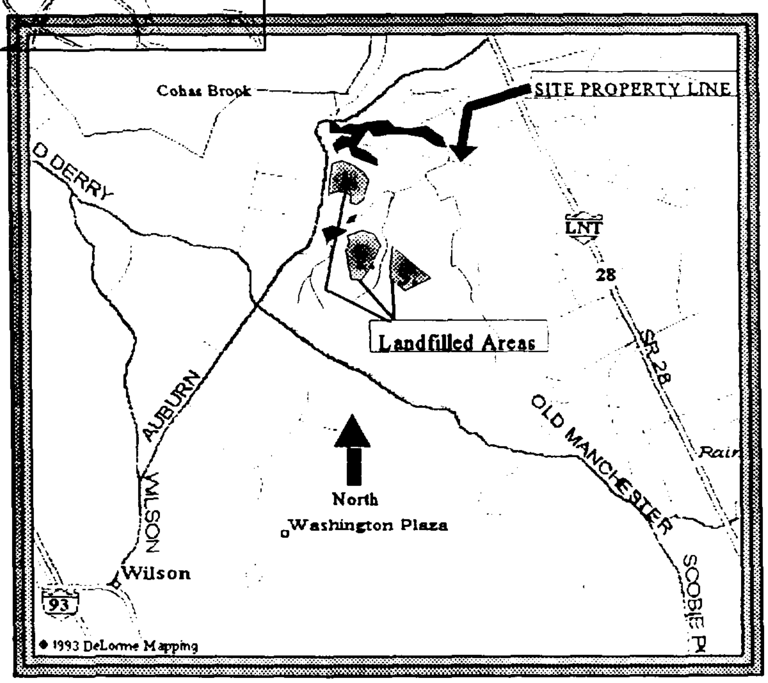
This Amended Record of Decision changes the ground water remedy from pumping and treating contaminated ground water to monitoring natural attenuation at the Site. Institutional controls will also be implemented to ensure protection of public health.

SITE DESCRIPTION: The Auburn Road Landfill site ("the site") is located in the northeast corner of the Town of Londonderry, New Hampshire. It consists of three, approximately four-acre disposal areas that received a mix of domestic wastes and various hazardous wastes until it was closed in 1980. The area is served by municipal water and the landfills were capped with RCRA-type C caps in 1994.

FIGURE 1. SITE LOCATION

The map at left shows the regional location of the Site. The map below shows a more detailed map of the site, the property bounds, the landfilled areas, Whispering Pines Pond (directly above the property line), and Cohas Brook.





The landfill lies in Londonderry, close to the borders of the Towns of Auburn and Derry, New Hampshire. The area surrounding the site is zoned for light residential and business use. Consistent with zoning, the area to the west and north of the site consists of light, rural, residential use and a gravel removal business. To the east is a large, undeveloped area that eventually gives way to light residential and business use in the vicinity of the Route 28 Bypass. To the south is more light residential use and a gravel operation. Figure 1, on the following page, shows the location of the site.

The site is approximately bounded by Auburn Road to the west, Old Derry Road to the south, State Highway 28 Bypass to the east, and the Londonderry-Auburn town line to the north. A number of houses surround the site. The site is located in a rural-residential area with approximately 300 homes and a trailer park with approximately 260 units within 1 mile of the site. In response to an EPA Record of Decision, the Town of Londonderry installed a water main on Auburn Road to provide municipal drinking water to potentially exposed residents and the trailer park.[1] No one is drinking ground water contaminated by the site.

The site consists of 200 acres that slopes gently downward from south to north. The southern portion of the site is approximately 330 feet above sea level. The terrain is gentle, falling to roughly 270 feet above sea level over a distance of approximately 2,000 feet. However, because this area was also formerly a gravel mining operation, some locally steep banks and disturbed areas are present. Gravel removal occurred in several locations at the site; however, the largest portion of the operation was in the north, in close proximity to the landfilling operations. Much of the mined out, disturbed areas contain no vegetation because only sand was left. In undisturbed areas that surround the site, including along Auburn Road, are stands of varying ages of White Pine and many hardwoods such as Poplar.

Although the site property consists of approximately 200 acres, the three disposal areas occupy only a total of 13 acres. The disposal areas consist of what are now three landfilled areas that have a top cover and no baseliner. The cover is a modified RCRA C cap, roughly four feet thick, with a geotextile impermeable

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[1] *Auburn Road Record of Decision*, U.S. Environmental Protection Agency, September 17, 1986.

membrane, a clay liner, and a vegetated (grass) cap. Formerly a septage disposal area existed to the north of the solid waste dump (listed as area "3" on Figure 1); however, the town excavated that area and disposed of it in the solid waste area in 1993. The landfills and the surrounding area are shown on Figure 2. The landfilled areas total 13 acres and each is roughly four acres in size. Northern-most of the disposal areas is the "Old Town Dump." The Old Town Dump is the oldest of the disposal areas and the refuse is roughly eight to fifteen feet in thickness. The Tire Pile and the Solid Waste Landfill occupy the southern portion of the site. The "Tire Pile" was so named because of the large amount of tires disposed of in this area. The Tire Pile is slightly larger than the Town Dump; however, it is just slightly thicker, ten to twenty feet in depth. The Solid Waste Landfill appears to be much thicker; however, that is due to landfilling on an existing hill, and is only eight to ten feet thick.

Surface waters at the site flow between the landfilled areas and lie to the east and north of the disposal areas. Whispering Pines Pond lies, in part, on the northern boundary of the site and accepts all surface water flows from the site. The wetland area to the east is actually a stream, periodically dammed by beavers, that empties into Whispering Pines pond. A seven acre wetland and drainage structures were created in the area between the Solid Waste landfill and the Tire Dump by the Town in order to replace affected wetlands and lower the water table in the area of the landfills. The wetland area and drainage structures flow northward to Whispering Pines Pond. None of the disposal areas lie within the 100-year floodplain of any stream although the Old Town Dump lies very close to the 100-year floodplain of the Pond.

Whispering Pines Pond is formed by a concrete dam at the northwest corner of the Pond. The stream that flows from the Whispering Pines Pond runs a short distance before discharging to Cohas brook, a few hundred feet to the north. Cohas Brook drains an area of roughly eleven square miles and is a tributary of the Merrimack River. The confluence of Cohas brook and the Merrimack River lies roughly 8 miles to the west, in the city of Manchester. On the next pages Figure 2 shows the site and the surrounding topography, Figure 2a shows the site with only the pertinent features highlighted.

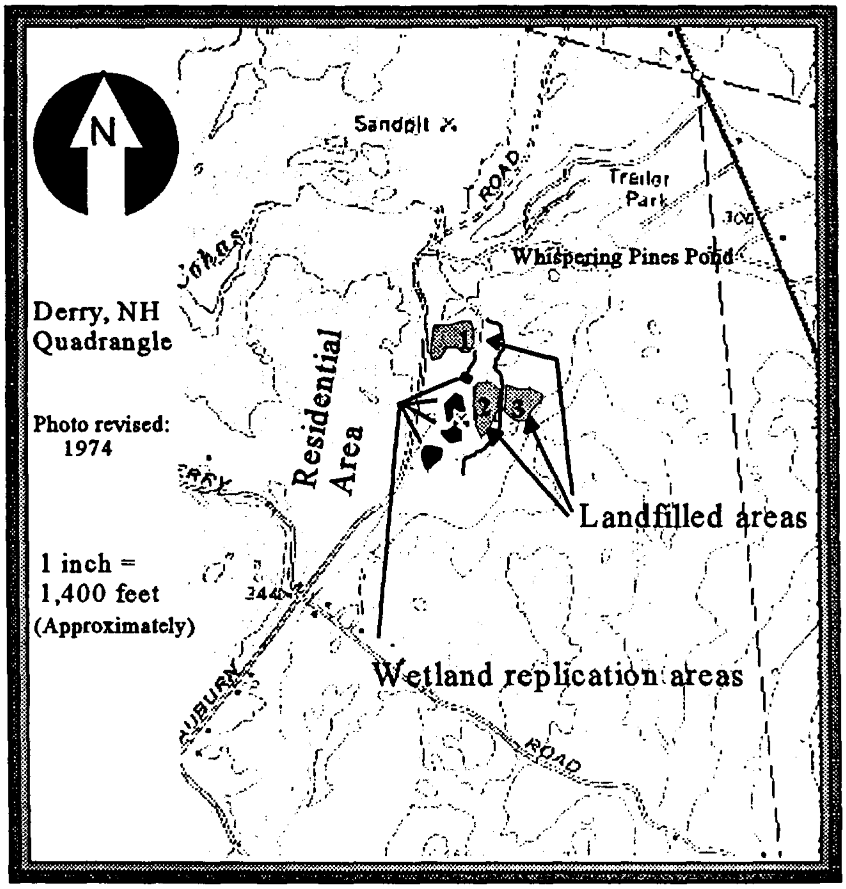

FIGURE 2, SITE AND SURROUNDING FEATURES. Site features are displayed on a USGS topographic map. The site features that have been added include the three disposal areas shown in orange, the wetland replication area, and the location of a residential area that was not present at the time the map was updated. Waterbodies may also not be depicted accurately due to filling and other alterations associated with time and landfill construction. The three disposal areas consist of the Town Dump (1), the Tire Dump (2), and the Solid Waste Landfill (3). Each disposal area covers roughly four acres. The wetland replication area totals seven acres. On-site surface water flows to the north to Whispering Pines Pond and then into Cohas brook which flows approximately eight miles eastward to the Merrimack River.

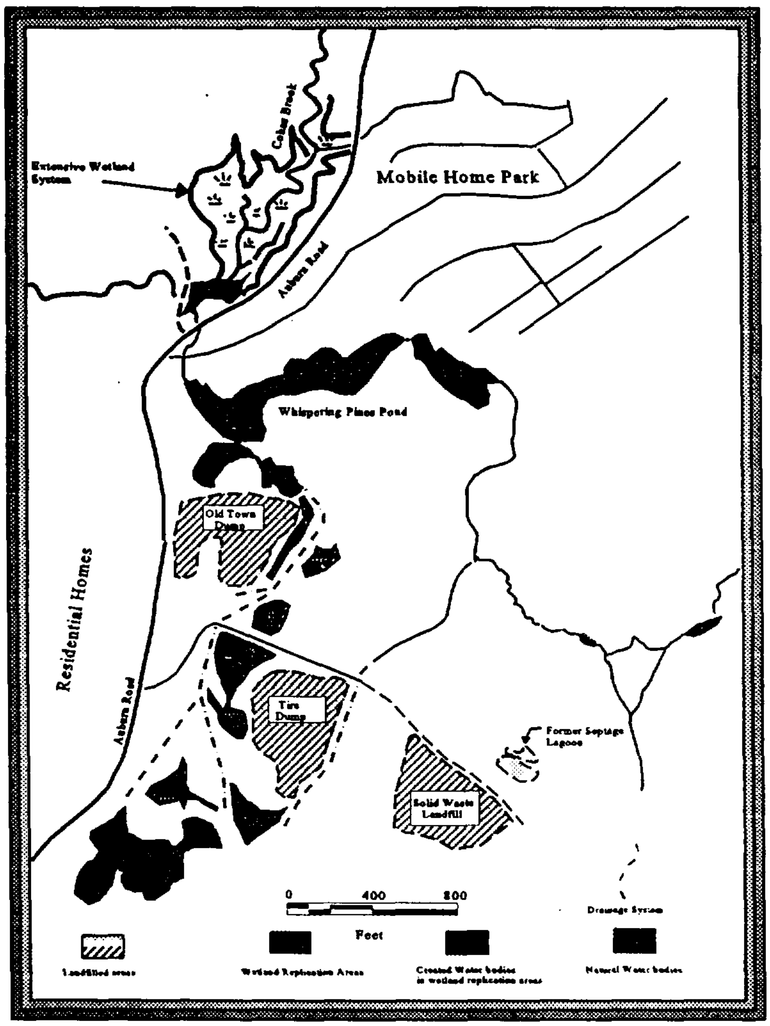

FIGURE 2A. SITE DETAIL.. This map shows the pertinent portions of the site and the remedy. Already constructed are the caps, shown in the checkerboard pattern, the drainage swales to keep the landfill dewaterered, shown in a blue dashed line, and the wetland replication area. The septage lagoon was excavated and placed in the Solid Waste Landfill.

The general geology at the site is typical of New England, glacial deposits overlying a bedrock surface. The glacial deposits may be further divided into thick outwash deposits of sand and gravel that overlie a thin, discontinuous till unit. The sands and gravels were reworked by glacial streams to create well-graded deposits and range in thickness from 0 feet in the southern part of the site to 75 feet to the north of the site in the vicinity of Whispering Pines Pond. The till varies from 0 to 20 feet and contains sand, gravel, silt, and clay. Figure 3 shows two cross-sections taken from the lines indicated on the plan.

Ground water at this site is divided into two units: the bedrock aquifer and the overburden aquifer. The overburden aquifer includes the outwash deposits and the till aquifer. Ground water flow within the overburden aquifer is to the north. Whispering Pines Pond receives some ground water from localized recharge; however, the majority of ground water from the site discharges to Cohas Brook. Hydraulic conductivities within wells in both the outwash deposits and the till vary from 0.1 to 140 feet per day.

The bedrock underlying the site consists of foliated chlorite/biotite schists and phyllites. The tendency of these rocks, in this terrain is to develop orthagonal faults and joints with a distinct orientation that may be conducive to ground water flow. Fractures in bedrock at the site have a definite northeast-southwest and northwest-southeast trend. A steep zone of faulting parallels Auburn Road and is oriented in a north northeast-south southwest direction. This fault, indicated by a thick zone of mylonite, was encountered in the drilling of wells R-1 and R-2. This fault does not appear to transmit ground water either along its strike or westward of its strike due to either mylonite formation, or healing through silicification.[2] Fractures east of this fault, underlying the site, are oriented further clockwise from the Auburn Road Fault and exhibit a northeast strike and a southeast dip of between 50 and 70 degrees. A small set of fractures run perpendicular to the northeast striking set although the dip appears to be indeterminate.[3]

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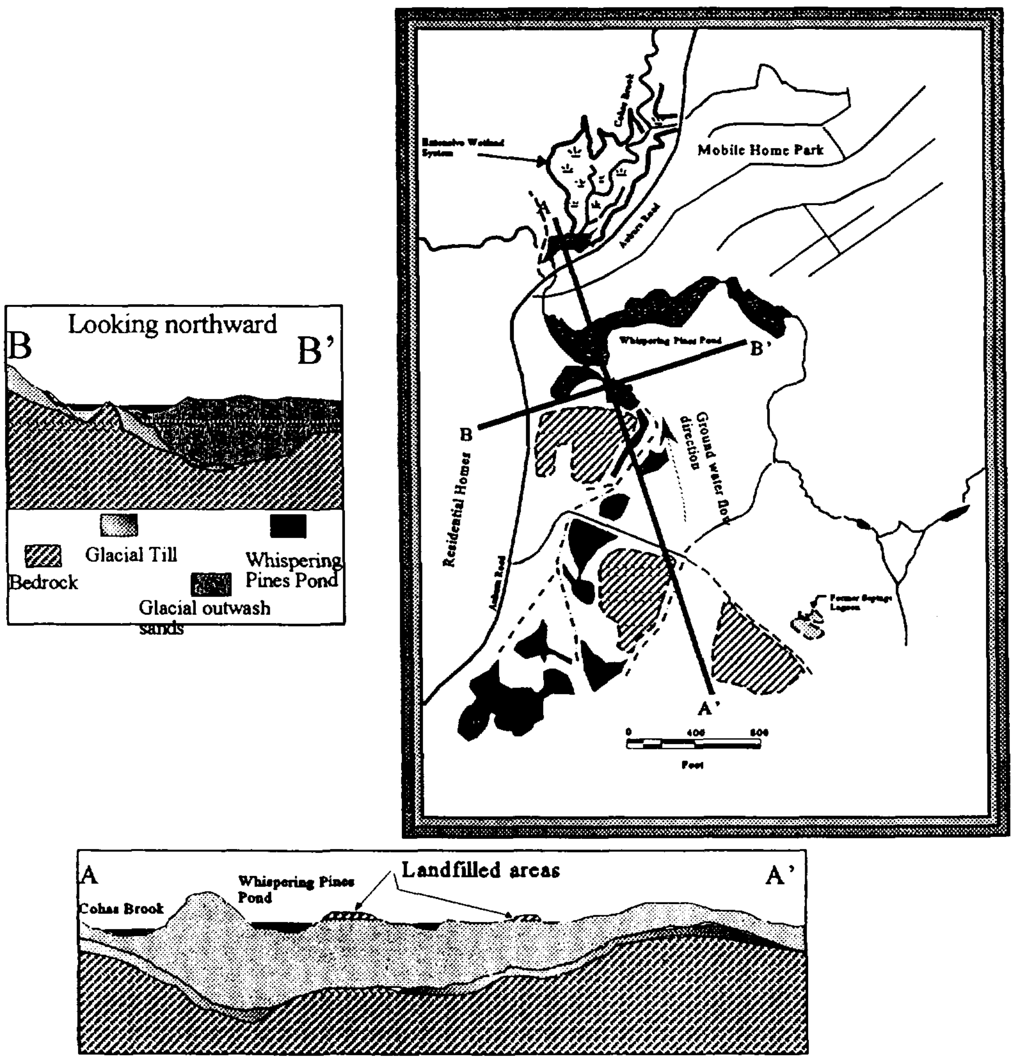
[2] Carol White, Sevee & Mahar, verbal communication with Darryl Luce, June 1995.

[3] *Auburn Road Landfill Remedial Investigation Report*, NUS Corporation, April 10, 1986.

What the information on the bedrock geology implies is that the flow of contaminated ground water in bedrock is limited to flow within narrow, well-defined and well-oriented zones that trend roughly northwest-southeast and northeast-southwest. Ground water flow within the bedrock aquifer is controlled by the structural orientation of the fractures. The silicified and mylonitized fault zone probably serves as a hydraulic barrier between the site and the former residential wells to the west. Evidence of this was the poor production from wells R-1 and R-2 which despite being over 400 feet deep, produce only about 1 gallon per minute. However, it is likely that the subparallel fractures that lie just to the east, and directly beneath the site, are conduits of ground water and allow it to migrate principally to the northeast and northwest in minor amounts.

The EPA performed a number of investigations in the study area, a more complete description of the area surrounding the site may be found in *Auburn Road Remedial Investigation Report,* NUS Corporation for EPA, April 10, 1986. A depiction of the general geology is shown in Figure 3 through the use of cross-sections taken at right angles through the site. Ground water flows to the north, or the top of the page on Figure 3.

FIGURE 3, SITE GEOLOGY. Two geologic cross-sections tanken at right angles through the site as shown on the plan view at right. The upper box on the left is the slice B-B' and is as if the reader were looking northward. The lower box is the slice A-A' and is as if the reader were looking roughly eastward. No scale is attached because these figures are generalizations. The depths vary but on-site the Glacial outwash sands are approximately forty to seventy feet thick. The overall geometry of the bedrock is a narrow trough that points, and deepens, to the north. A thin layer of glacial till, which consists of clay and rock fragments, lies on the bedrock. The outwash deposits, made up of sands and gravels, makes up the general topography and is mined extensively throughout the area.



II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

A. Land Use and Response History

From 1965 until 1980 the site operated as a municipal landfill. In August 1979, an investigation by the State of New Hampshire substantiated suspicions that industrial wastes were being disposed of on the site and the State ordered that no more drums be accepted for disposal at the site. Following a Preliminary Site Assessment, a subsequent hydrologic investigation, and a Hazard Ranking System (HRS) score of 36.6, the EPA proposed the site for listing on the National Priority List (NPL) in December 1982. The U.S. Congress formally included the site on the NPL in September 1983, ranking 383 out of 416 sites nationally at that time.

Since the site has been on the NPL, the EPA and State have generated the following documents related to the preliminary investigations of the site:

Auburn Road Remedial Investigation Report, NUS Corporation for USEPA, April 10, 1986. Three volumes.

Auburn Road Landfill Endangerment Assessment, Planning Research Corporation for USEPA, July 1986. Two volumes.

Auburn Road Landfill Site Final Focused Feasibility Study Report, NUS Corporation for USEPA, July 8, 1986.

The above documents resulted in a September 17, 1986 Record Of Decision that directed the installation of a 9,000 foot water line to supply uncontaminated drinking water to the residents surrounding the landfill. After the Town installed the waterline in 1987 and the EPA had removed over 2,000 drums of hazardous wastes from the site in 1986, the EPA believed that conditions at the Landfill had changed sufficiently to re-evaluate the site. The EPA then produced the following documents at the conclusion of the re-evaluation:

Supplemental Remedial Investigation Report for the Auburn Road Landfill Site, R.F. Weston for USEPA, October 21, 1988. Three volumes.

Feasibility Study Report for the Auburn Road Landfill Site, R.F. Weston, Inc. for USEPA, March 1989. Two volumes.

These documents resulted in a September 29, 1989 Record of Decision that directed the construction of a ground water treatment plant to remove metals and volatile organics from ground water and a cap over the diposal areas to prevent infiltration through landfilled wastes. To implement the provisions in the ROD, the EPA issued an Unilateral Administrative Order to nine respondents on August 31, 1990. That Order directed that the Town of Londonderry would cap the disposal areas and that a separate group of PRPs would cleanup the contaminated ground water. The Town completed construction of the cap over the landfill in 1994. However, the ground water remedy was not built.

When the EPA issued the Administrative Order to clean up the ground water five of the eight respondents formed a Management of Migration group,. or MOM group, and produced the following documents:

Initial Pre-Design Investigation, Sevee & Maher Engineers, Inc., January 1992.

Supplement I Investigation Report, Supplemental Pre-Design Investigation for Remediation of Groundwater, Sevee & Maher Engineers, Inc., January 1993.

Supplement II Investigation Report, Supplemental Pre-Design Investigation for Remediation of Groundwater, Sevee & Maher Engineers, Inc., August 1993.

The sampling that the MOM group performed during these investigations pointed to the following conclusions:

- that volatile organic compound (VOC) contamination decreased significantly from 1986. In 1991 no VOCs exceeded the 1989 ROD cleanup levels beyond the site boundary.

- that arsenic was the only contaminant which exceeded the 1989 cleanup levels beyond the site boundary.

- that capping the landfills and lowering the water table to prevent ground water from percolating through the landfill would be the most effective way to reduce arsenic contamination in the ground water.

The respondents have produced annual monitoring reports for the periods 1993, 1994, and 1995. It appears that VOC contamination continues to decline due to dilution, biodegradation, and abiotic processes. Arsenic contamination has not declined. However, the Town finished capping the landfill in 1994, therefore not enough time has passed to gauge the effectiveness of the cap.

In response to this information the EPA began to reconsider the ground water remedy proposed in the 1989 ROD. In April 1996 the EPA issued the Proposed Plan for this site outlining a three remedial options and indicating a preference for the Limited Action remedy.

B. Enforcement History

From 1984 until 1989, the EPA conducted an investigation to identify parties who are liable for response costs at the site. In this regard, EPA issued approximately 200 information requests, employed private investigators, conducted numerous interviews, and reviewed a multitude of records. At various times throughout the duration of this project, as information became available, parties who EPA determined either owned or operated the site, generated wastes that were sent to the site, arranged for disposal of hazardous substances at the site or transported hazardous substances to the site, were notified of their potential liability with respect to the Site. To date, 21 parties have been notified.

On August 31, 1990 the EPA issued an Administrative Order to two groups of potentially responsible parties to perform the remedies outlined in the 1989 Record of Decision. The EPA's Order directed the Town of Londonderry to perform the Source Control component of the remedy. The Source Control remedy is to cap the landfill and perform drainage improvements to minimize the contact of ground water with the waste in the landfill. The second half of the Order directed a group of PRP's known as the MOM group to design and build the Management of

Migration portion of the remedy, the ground water treatment plant.

In June 1994 the EPA and State of New Hampshire entered into dispute resolution with a number of groups to settle litigation at the site. The parties to the dispute resolution are the Town of Londonderry; the MOM group including BASF Corporation, Disogrin Corporation, Waste Management of New Hampshire, Lockheed Sanders, Inc., and General Latex & Chemical Corporation; Exxon; and a number of third parties brought in by the Town of Londonderry. Peter Johnson who is the former owner of the Landfill was invited to participate but declined the offer.

Litigation has been stayed during the process of these negotiations with the exception of those actions taken against non-settlers.

III. COMMUNITY PARTICIPATION

Throughout the site's history, community concern and involvement has varied. Initially, the public's interest was very strong. However, as site activities have progressed, interest has waned. A few individuals, direct abuttors, retain a keen interest in the cleanup process. EPA has kept the community and other interested parties apprised of the site activities through informational meetings, fact sheets, press releases and public meetings.

During June, 1984 EPA released a community relations plan which outlined a program to address community concerns and keep citizens informed about and involved in activities during remedial activities. Since that time the EPA has held the following meetings related to the site:

June 28, 1984: Informational meeting to describe the plans for the Remedial Investigation and Feasibility Study.

May 21, 1985: Informational meeting to discuss results of the Remedial Investigation.

April 30, 1986: Informational meeting to discuss results of the Remedial Investigation.

July 30, 1986: Informational meeting to discuss the Focussed Feasibility Study.

August 6, 1986: Public meeting to receive comments on the Focussed Feasibility Study.

October 27, 1987: Informational meeting to discuss the Supplemental Remedial Investigation.

September 27, 1988: Informational meeting to discuss the second barrel removal action.

March 22, 1989: Informational meeting to discuss the Feasibility Study results and EPA's Proposed Plan.

March 30, 1989: Second informational meeting for those people who could not attend the March 22nd meeting.

April 25, 1989: Public hearing to receive comments on the Feasibility Study and the Proposed Plan.

June 22, 1992: Informational meeting to discuss the design for the landfill cap and the results of the ground water Pre-Design Investigation.

April 24, 1996: Public meeting to discuss the results of site sampling and EPA's Proposed Plan.

May 16, 1996: Public hearing to receive comments on the site conditions and the Proposed Plan.

In addition, during construction of the landfill caps during 1993 and 1994 SEA Consultants, Engineers for the Town of Londonderry, released a number of fact sheets to inform the public of construction activities at the site.

In April 1996, EPA made the administrative record available for public review at EPA's offices in Boston and at the Leach Public Library in Londonderry, New Hampshire. EPA published a notice and brief analysis of the Proposed Plan in *The Manchester Union Leader* on April 17, 1996 and made the plan available to the public on April 12, 1996.

On April 24, 1996, EPA held an informational meeting to discuss the results of the Remedial Investigation and the cleanup alternatives presented in the Feasibility Study and to present the Agency's Proposed Plan. Also during this meeting, the Agency answered questions from the public. From April 25, 1996 through May 24, 1996, the Agency held a 30 day public comment period to accept public comment on the alternatives presented in the Feasibility Study and the Proposed Plan and on any other documents previously released to the public. On May 16, 1996, the Agency held a public meeting to discuss the Proposed Plan and to accept any oral comments. A transcript of this meeting and the comments and the Agency's response to comments are included in the attached Responsiveness Summary in Appendix E.

IV. SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

In 1989 the EPA issued a Record of Decision that selected Landfill capping and ground water pump and treat as a comprehensive approach to site remediation. In 1991 the PRPs began the pre-design investigation to build the ground water cleanup facility. The ground water data from the pre-design investigation caused the EPA to reconsider the necessity for constructing a ground water pump and treat system. The Town of Londonderry completed capping the landfill in 1994. Only the ground water remedy remains to be completed to fully implement the 1989 ROD.

Samples taken during the Ground Water Remedy Pre-Design indicated that site ground water contamination conditions had changed dramatically from 1986. The 1986 data were the basis of the ground water cleanup dictated in the 1989 ROD. The pre-design samples demonstrated that the volatile organic compounds (VOCs) that had contaminated much of the aquifer were now below the cleanup levels set by the 1989 ROD. Only arsenic remained in concentrations sufficient to pose a risk. The change in ground water conditions prompted the EPA to re-examine the ground water cleanup strategy.

The EPA believes that the low-permeability cap placed on the landfills will halt the leaching of contaminants and other materials from the landfills. Geochemical modeling has demonstrated that capping the landfill should result in arsenic attaining cleanup levels off site within five years.

In this Amended Record of Decision the EPA is modifying the decision in the 1989 ROD to build a ground water pump and treat facility. The response action that the EPA is now selecting to clean up the contaminated ground water is limited action which includes:

- restoration of ground water through natural attenuation;

- the development and implementation of a revised ground water, surface water, sediment and air sampling program that provides for investigation and action contingent upon sampling data that show any of the following:

1. an increase in ground water contamination.
2. toxicity to aquatic life or a public health risk from arsenic contamination in sediments.
3. a human health or ecological risk from contaminants in surface water.

- the establishment of a Groundwater Management Zone, within which ground water will be restored;

- the establishment of institutional controls to notify and prevent residents from using contaminated ground water in the overburden and bedrock aquifers;

- the continued maintenance of the landfill caps and drainage system to restrict ground water movement through the disposal areas to the greatest degree possible; and

- a review of site conditions every five years.

The EPA developed the selected remedy in consideration of other remedial actions taken at the site, current site conditions, and other investigations. Earlier remedial actions at the site that have reduced or eliminated public health risks or threats to the environment include:

- providing a municipal drinking water supply to residents whose wells were contaminated or threatened by contamination in ground water from the site;

- construction of a RCRA type C low-permeability cap on top of the three disposal areas. Ground water modeling has shown that arsenic should meet cleanup levels off-site within five years after the landfill is capped; and

- construction of drainage swales around the landfills to lower the water table in the vicinity of the disposal areas and thereby minimize contact of the water table with the wastes.

This remedial action will address the only threat to human health posed by the site: the future consumption of ground water for drinking water purposes. This remedial action will also address any future contamination that poses a threat to public health and the environment.

V. SUMMARY OF SITE CHARACTERISTICS

The significant findings of the 1989 Remedial Investigation and subsequent investigations are summarized below.

A. Soil and Sediment

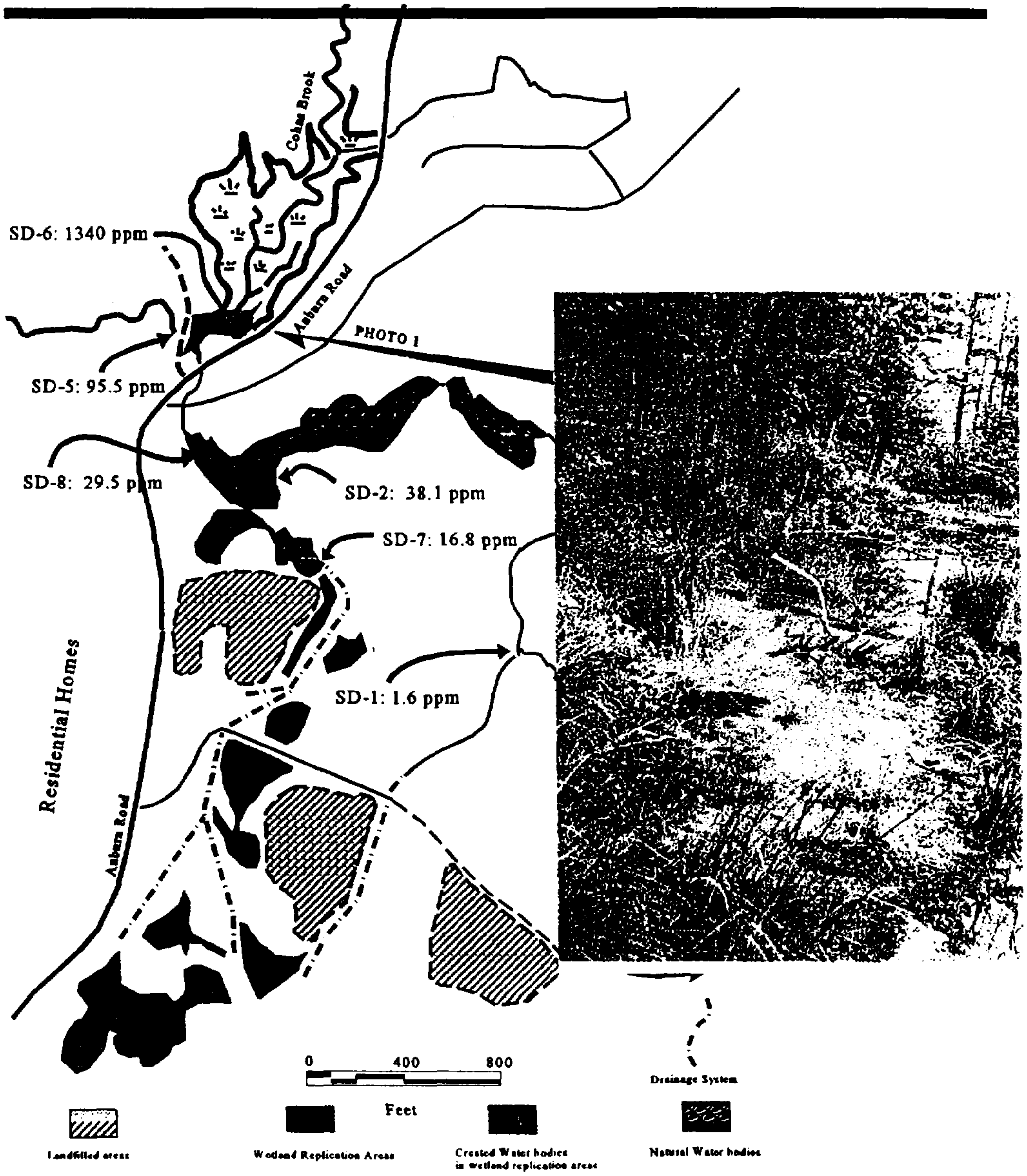
In 1989 EPA's Record of Decision described four areas of soil contamination. Those areas were the four separate landfills at the Site. The contaminants found in these areas included volatile organic compounds, semi-volatile organic compounds, polychlorinated biphenyls, and pesticides. The contaminated materials in those areas are now covered by a cap sufficient to eliminate human exposure to those contaminants.

Concentrations of arsenic exist in the soil and in the sediments in water bodies that abut the Site. Although arsenic appears naturally in both the ground water and soil in this part of New Hampshire, the arsenic at issue here is not naturally occuring. Rather, the arsenic present in sediments and ground water at the site results from geochemical conditions created by the contamination within the landfill. However, the concentrations of arsenic do not pose any significant risk to public health or the environment. Because the arsenic co-precipitates with the iron, no arsenic is seen in any significant concentrations in surface waters in Whispering Pines Pond. Most of the arsenic-contaminated ground water from the site discharges in a narrow area of wetlands that borders Cohas Brook. Elevated concentrations in sediment, but again not in surface water, were reported in the 1995 Draft Annual Monitoring Report for the area in Cohas Brook in which ground water from the site appears to discharge. Figure 4 displays the concentrations for arsenic-in-sediments throughout the area of the site. Photo 1 shows the ground water seeps in the wetlands adjacent to Cohas Brook.

Because the *1995 Annual Report*[4] reported what appeared to be significant increases in sediment concentrations of arsenic, the EPA chose to resample the area of the highest concentration and the areas around it. The EPA also chose to sample sediments to gauge their toxicity to organisms rather than for just the specific contaminant. The analysis consisted of taking a large amount of the sediment and allowing an insect, an amphipod - *Hyalella azteca,* to live in the sample for ten days and record how many of the organisms live and die. The percentage of the amphipod mortality is a gauge of the relative toxicity of the sediment. The results showed no significant mortality to test organisms. Additional details of the investigation into sediment toxicity are contained in Appendix D. Sampling has shown that none of the areas sampled pose a public health risk or are toxic to aquatic life.

[4] *1995 Annual Report Long-term Environmental Monitoring Program, Auburn Road Landfill Site, Londonderry, New Hampshire* (Draft), Sevee & Maher Engineers, Inc.. April 1996.

FIGURE 4 AND PHOTO 1, SEDIMENT CONTAMINATION. The results of sediment sampling, in parts per million, that was performed in August 1995. Photo1 shows the staining of sediments from iron precipitation that contains some arsenic adjacent to Cohas Brook. Photo 1 is standing on the edge of the ponded area, looking westward, the pond is to the right of the photo and Auburn Road lies approximately ten feet to the left of the edge of the photo.



B. Ground Water

Ground water at the site flows north ward. Although some ground water flows into Whispering Pines Pond, this is only very localized flow and most of the flow is towards, and into, Cohas brook. Ground water travel times are fast because of the permeable sands and gravels that make up much of the aquifer.

Prior to 1986 and through 1989 VOCs were wide-spread in ground water at the site and were highly concentrated.[5] Sampling conducted in 1991 and 1992 found that much of the VOC contamination was below the 1989 ROD cleanup levels.[6] The primary fate of the contaminated ground water was either by flowing from the aquifer into Cohas Brook, or the contaminants were consumed by bacteria within the aquifer. It is likely that both processes acted to reduce contaminant concentrations in the ground water. The contaminants in the ground water that had discharged to surface water were either destroyed by ultraviolet radiation or reaction with highly oxygenated water (hydrolysis).

Table 1 compares the concentration of each contaminant of concern for the site between 1984 and 1995. The VOCs have diminished in both frequency of detection and maximum concentration. In 1995 only one well is found that has exceedences of the cleanup levels set for the VOCs and that well, MW102A, directly abuts the Town Dump. No off-site wells were found to contain VOCs that exceeded the cleanup level.

The majority of the VOC contamination in ground water is below cleanup levels that were set in the 1989 ROD. The only significant contamination from the site that remains is arsenic in ground water. Ground water contaminated with arsenic forms a narrow plume that courses northward across the site and appears to discharge into Cohas brook. The arsenic contamination is either the result of the slow leaching of arsenic from contaminated wastes within the landfill or it may be

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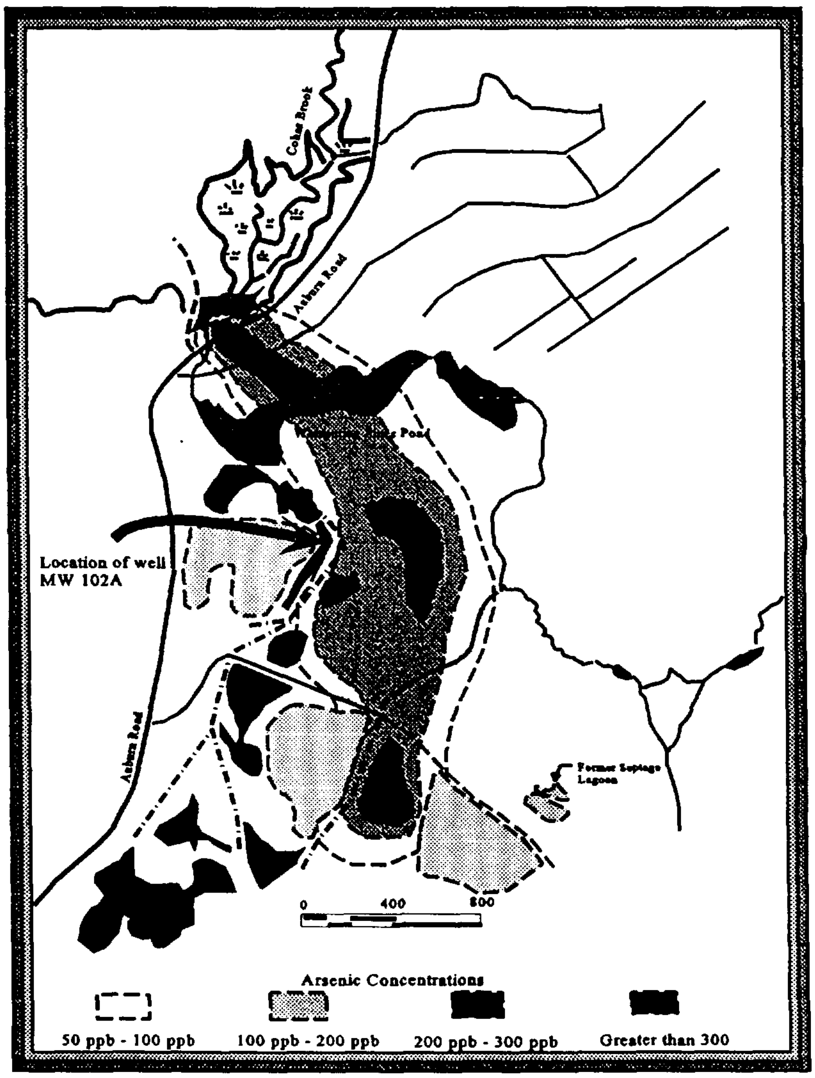
[5] *Auburn Road Landfill Remedial Investigation Report,* NUS Corporation, April 10, 1989.

[6] *Supplement II Investigation Report, Supplemental Pre-Design Investigation for Remediation of Ground water,* Sevee & Maher Engineers, Inc., August 1993.

the result of contamination within the landfill changing the geochemical conditions in the aquifer. The theory behind how the arsenic contaminating ground water may be generated by contaminants from the landfill is outlined in Appendix C.

FIGURE 5. Arsenic and VOC contamination in 1995. VOCs exist in concentrations that exceed cleanup levels in one well, MW-102A. Arsenic is widespread and exceeds the cleanup levels in many wells throughout the site. The contaminant plume is shown beneath water bodies and surface features because the highest concentrations of arsenic lie forty to fifty feet below the ground surface except in those areas in which ground water comes to the surface such as near some portions of Whispering Pines Pond and Cohas brook.

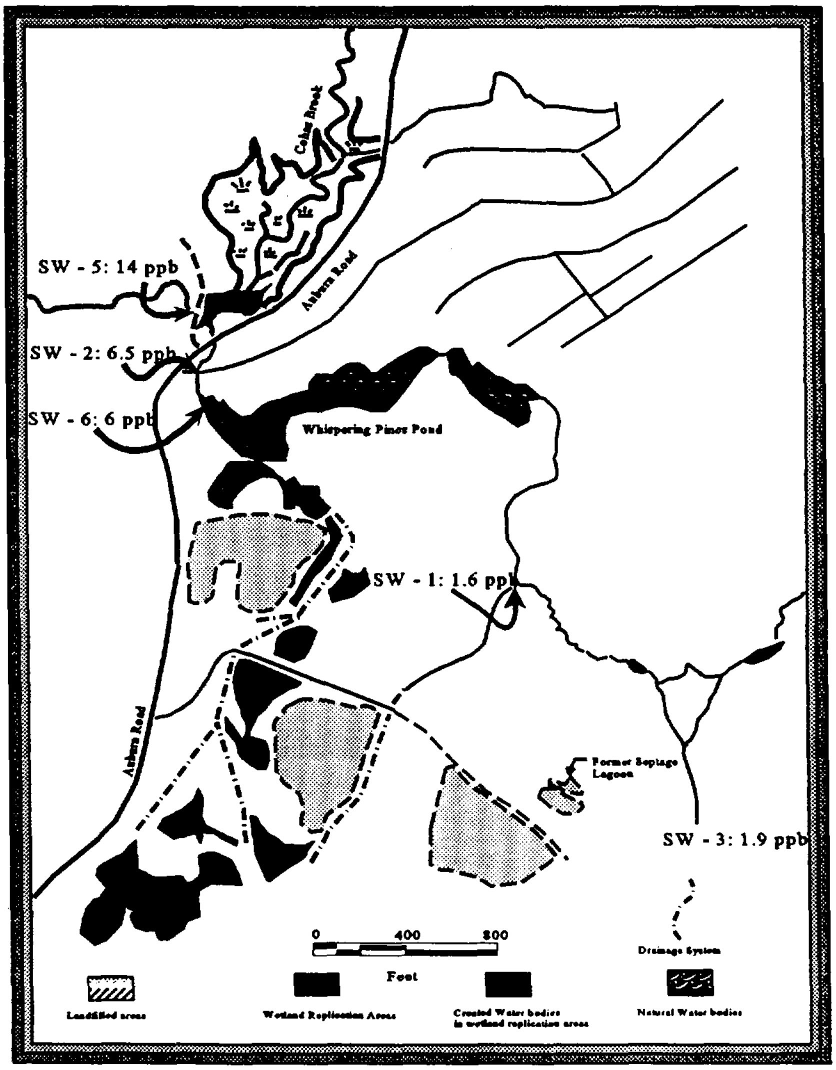


C. Surface Water

The ground water containing the arsenic flows to, and discharges to, Cohas Brook and a smaller amount to Whispering Pines Pond. However, sampling has shown that the arsenic does not discharge into the surface water of the ponds. Instead, as the arsenic-contaminated ground water approaches the stream or pond bed, oxygen-rich water contacts the contaminant-containing ground water and changes the water chemistry. The arsenic and iron (most of the plume is actually composed of iron) precipitates in the sediments. The result is that surface water concentrations of arsenic are similar to the regional background.

In 1986 and 1989 very low levels of VOCs, less than 20 parts per billion, were found in surface water during sampling conducted for the Remedial Investigation. Due to the low concentrations in ground water and surface water, no further sampling for VOCs was performed. The location of sampling points and the values for each are shown on Figure 6.

FIGURE 6. Location of surface water sampling points sampled in August 1995. Arsenic concentrations are shown for each of the surface water (SW) sampling points in parts per billion.



D. Air

Air samples were taken three times during the Remedial Investigation. Only very low levels of VOCs, less than 16 parts per billion, were found. The landfill has not accepted any waste in over seventeen years. It is not expected that significant emissions from the landfill occur. However, as a portion of the Operations and Maintenance plan for the Source Control Remedy, the Town will monitor air quality at appropriate intervals.

VI. SUMMARY OF SITE RISKS

Site risks are comprised of risks to human health and the environment. The contaminants of concern in this Record of Decision are a smaller subset of those selected in the 1989 Record of Decision because many of the contaminants that were of a concern then are no longer present in significant concentrations at the site. Therefore, the results of the risk assessment presented below are based on data collected from 1993 until 1995. Ecological risk was examined in greater detail due to high concentrations in stream sediments reported in the 1995 Annual Report.[7]

A. Risk to Human Health

In 1986 EPA performed an Endangerment Assessment (EA)[8] to estimate the probability and magnitude of potential adverse human health and environmental effects from exposure to contaminants associated with the site. The public health risk assessment followed a four step process:

1) contaminant identification, which identified those hazardous substances which, given the specifics of the site were of significant concern;

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[7] *1995 Annual Report, Environmental Monitoring Program, Auburn Road Landfill...*, Prepared by Sevee & Maher Engineers for the Management of Migration Group, April 1996.

[8] *Auburn Road Landfill Endangerment Assessment*, Planning Research Corporation for USEPA, July 1986. Two volumes.

2) exposure assessment, which identified actual or potential exposure pathways, characterized the potentially exposed populations, and determined the extent of possible exposure;

3) toxicity assessment, which considered the types and magnitude of adverse health effects associated with exposure to hazardous substances; and

4) risk characterization, which integrated the three earlier steps to summarize the potential and actual risks posed by hazardous substances at the site, including carcinogenic and non-carcinogenic risks.

In the 1986 EA the EPA showed that risks posed by future, potential ingestion of ground water were outside of EPA's acceptable risk range and led the EPA to set cleanup levels for ground water. The EPA determined that concentrations of contaminants in soils, sediments, surface water and air did not pose a risk outside of EPA's acceptable range.

The 1989 Record of Decision listed nine contaminants of concern. The nine contaminants were selected and evaluated in the Endangerment Assessment. The nine contaminants of concern were selected to represent potential site related hazards based on toxicity, concentration, frequency of detection, and mobility and persistence in the environment. A summary of the health effects of each of the contaminants of concern can be found in Section 6 of the 1986 Endangerment Assessment. The maximum concentration and frequency of detection of the nine contaminants of concern in 1989 are compared to their concentration and frequency found in 1995 in Table 1. Three of the nine compounds, 1,2 dichloroethylene, 2-butanone, and toluene are no longer found in concentrations that exceed the cleanup level. Although lead has an established cleanup level, it has not exceeded that level, 50 parts per billion, nor has it exceeded EPA's action level of 15 parts per billion. All compounds, except arsenic, have greatly reduced concentrations and frequencies.

In 1993, 1994, and 1995 EPA conducted additional sampling of ground water, surface water, and sediment. The results of these sampling events were used to assess risks to human health and the environment.[9]

TABLE 1 - COMPARISON OF 1984 TO 1995 DATA				
CONTAMINANT CLEANUP LEVEL	YEAR	FREQUENCY (detect / wells)	# WELLS (exceeding cleanup level)	HIGH in parts per billion (ppb)
Vinyl Chloride 2 ppb	1984	10 / 65	10	82
	1995	2 /15	1	6
t-1,2 Dichloroethene 70 ppb	1984	44 / 65	25	330,000
	1995	1 / 14	0	6
2-Butanone 172 ppb	1984	21 / 65	14	12,000
	1995	7 / 15	0	6
Trichloroethene 5 ppb	1984	24 / 65	20	1,600
	1995	5 / 15	1	44
Tetrachloroethene 5 ppb	1984	22 / 65	16	8,500
	1995	1 / 15	1	100
Benzene 5 ppb	1984	8 / 65	7	12
	1995	7 / 15	1	6
Toluene 2,000 ppb	1984	34 / 65	4	6,500
	1995	5 / 15	0	6
Arsenic 50 ppb	1984	11 / 15	7	130
	1995	26 / 37	19	354

[9] Memoranda from Margaret McDonough to Darryl Luce, March 1996, June 1996, and November 18, 1996.

Potential human health effects associated with exposure to the contaminants of concern were estimated quantitatively or qualitatively through the development of several hypothetical exposure pathways. These pathways were developed to reflect the potential for exposure to hazardous substances based on the present uses, potential future uses, and location. The area is rural, residential with residents representing all age groups. The following is a brief summary of the exposure pathways evaluated for exposure in 1996. A more thorough description of all the pathways considered and exposure scenarios used in 1986 may be found in Section 6 of the Endangerment Assessment.

Ground water - current: There is no current use of ground water for drinking water purposes.

Ground water - future: Potential use of ground water for residential drinking water was assumed.

Sediment - current and future: Dermal contact and incidental ingestion of sediments was evaluated.

For each pathway evaluated, an average and a reasonable maximum exposure estimate was generated corresponding to exposure to the average and the maximum concentration detected in that particular medium. Excess lifetime cancer risks were determined for each exposure pathway by multiplying the exposure level with the chemical specific cancer factor. Cancer potency factors have been developed by EPA from epidemiological or animal studies to reflect a conservative "upper bound" of the risk posed by potentially carcinogenic compounds. That is, the true risk is unlikely to be greater than the risk predicted. The resulting risk estimates are expressed in scientific notation as a probability (e.g. 1×10^{-6} for 1/1,000,000) and indicate (using this example), that an average individual is not likely to have greater that a one in a million chance of developing cancer over 70 years as a result of site-related exposure as defined to the compound at the stated concentration. Current EPA practice considers carcinogenic risks to be additive when assessing exposure to a mixture of hazardous substances. The acceptable risk range that EPA Region I uses lies between a total of 5×10^{-4} and 1×10^{-6} for carcinogenic risks.

The EPA calculated the hazard index for ground water considering its potential use as drinking water. The hazard index is EPA's measure of the potential for non-carcinogenic health effects. A hazard quotient is calculated by dividing the exposure level by the reference dose (RfD) or other suitable benchmark for non-carcinogenic health effects for an individual compound. Reference doses have been developed by EPA to protect sensitive individuals over the course of a lifetime and they reflect a daily exposure level that is likely to be without an appreciable risk of an adverse health effect. RfDs are derived from epidemiological or animal studies and incorporate uncertainty factors to help ensure that adverse health effects will not occur. The hazard quotient is often expressed as a single value (e.g. 0.3) indicating the ratio of the stated exposure as defined to the reference dose value (in this example, the exposure as characterized is approximately one third of an acceptable exposure level for the given compound). The hazard quotient is only considered additive for compounds that have the same or similar toxic endpoint and the sum is referred to as the hazard index (HI). (For example: the hazard quotient for a compound known to produce liver damage should not be added to a second whose toxic endpoint is kidney damage).

Below, each exposure pathway and scenario is discussed. Following that, the risks associated with assumptions are presented in Tables 2 through 4.

DRINKING WATER

Future potential exposure from the ingestion of ground water as a residential drinking water supply was evaluated. This pathway and scenario assumes that a future user of contaminated ground water will drink two liters of contaminated water for 350 days per year for 30 years. Tables 3 and 4 depict the carcinogenic and non-carcinogenic risk summary, respectively, for the contaminants of concern in ground water evaluated to reflect potential future drinking water use corresponding to the average and the reasonable maximum exposure (RME) scenarios. Because municipal drinking water is supplied to the area, no present risk values have been calculated. Table 2, for comparison purposes, examines the risk in ground water on-site, within the landfilled area which is not truly representative of what a future ground water user may extract for domestic drinking water purposes.

TABLE 2 - CARCINOGENIC RISKS FOR THE POSSIBLE FUTURE INGESTION OF GROUND WATER INSIDE THE PROPERTY LINE

CONTAMINANT	Concentration in parts per billion (ppb)		Exposure Factor (1/kg/day)	Cancer Potency Factor $(mg/kg/day)^{-1}$	Risk Estimate	
	average	maximum			average	RME
Vinyl Chloride (A)	0.5	6	average = 1×10^{-3}	1.9	2.3×10^{-6}	1.4×10^{-4}
Trichloroethylene (NA)	3.2	44		1.1×10^{-2}	8.4×10^{-8}	5.7×10^{-6}
Benzene (A)	0.9	6	RME = 1×10^{-2}	2.9×10^{-2}	6.2×10^{-8}	2.0×10^{-6}
Tetrachloroethylene (NA)	7	100		5.2×10^{-2}	8.7×10^{-7}	6.2×10^{-5}
Arsenic (A)	74	354		1.5	3.7×10^{-4}	6.3×10^{-3}
TOTAL					3.7×10^{-4}	6.4×10^{-3}

TABLE 3 - CARCINOGENIC RISKS FOR THE POSSIBLE FUTURE INGESTION OF GROUND WATER OUTSIDE THE PROPERTY LINE						
CONTAMINANT	Concentration in parts per billion (ppb)		Exposure Factor (1/kg/day)	Cancer Potency Factor $(mg/kg/day)^{-1}$	Risk Estimate	
	average	maximum			average	RME
Arsenic (A)	104	318	avg. = 2.9×10^{-2} RME = 1.2×10^{-2}	1.5	3.8×10^{-4}	5.6×10^{-3}

TABLE 4 - NON-CARCINOGENIC RISKS FOR THE POSSIBLE FUTURE INGESTION OF GROUND WATER INSIDE THE PROPERTY LINE							
CONTAMINANT	Concentration in parts per billion (ppb)		Exposure Factor (1/kg/day)	Reference Dose (mg/kg/day)	Target Endpoint of Toxicity	Hazard Quotient	
	avg.	max.				average	RME
1,2 Dichloroethylene (NA)	0.4	6	avg. = 1.9×10^{-2} RME = 2.7×10^{-2}	1×10^{-2}	Blood	0.0008	0.01
Toluene (D)	1	6		2×10^{-1}	Liver/Kidney	0.00009	0.0008
2- Butanone (D)	0.9	6		6×10^{-1}	Decreased body weight	0.00003	0.0003

SEDIMENT AND SURFACE WATER

The current and future potential for exposure from incidental ingestion of contaminants in sediments assumes that adolescents between the ages of 6 to 15 years old will visit Cohas brook. The access to contaminated sediments would be infrequent due to the location of nearby residents, the narrow road shoulder, and the heavy truck and high speed passenger car use. Therefore, an estimated exposure frequency of 20 days per year (once a week in summer months) for the RME and 10 days for the Central Tendency (CT) was assumed. Table 5 depicts the carcinogenic risk summary for the contaminant of concern in sediment evaluated to reflect present and potential future wading corresponding to the average and the reasonable maximum exposure (RME) scenarios. The carcinogenic risk for swimming in, or wading in, the surface water of Cohas brook was not calculated because the concentrations are very low and the exposure would not be frequent enough to generate any risk.

TABLE 5 - CARCINOGENIC RISKS FOR CURRENT WADING AND INCIDENTAL INGESTION OF SEDIMENT

	Concentration in parts per million		Exposure Factor (1/kg/day)	Cancer Potency Factor $(mg/kg/day)^{-1}$	Risk	
	Avg.	Max.			Avg.	RME
Arsenic	218	1,340	avg = 2.8×10^{-9} RME= 1.1×10^{-8}	1.5	9.0×10^{-7}	2.2×10^{-5}

Summary of Human Health Risks

The actions taken at the site have eliminated all significant present public health threats. The Town, by capping the thirteen acres of landfilled area, has halted the public's exposure to contaminated soils. The EPA, by removing over 2,000 drums of industrial wastes, eliminated the potential for present exposure to contaminated air and the future potential for the drummed wastes to further contaminate soil and ground water. The Town, by supplying municipal water to those affected by or threatened by contaminated ground water, has eliminated the potential for present exposure to contaminants in drinking water.

However, some portions of the population may be exposed to site contaminants in the present and future. Sediment and surface water in Whispering Pines Pond and Cohas brook are contaminated. However, the concentrations of those contaminants are within EPA's acceptable risk range under either present or future scenarios as outlined above.

The future carcinogenic risk of ingesting arsenic-contaminated ground water as drinking water is the only pathway that poses a significant public health risk. This is a future use scenario since no individuals are currently using contaminated ground water for drinking water purposes.

B. Ecological Risk

A qualitative Ecological Risk Assessment was performed prior to the 1989 ROD.[10] The assessment was inconclusive as to if ecological endpoints were affected by contaminants from the site. Since 1993 the Responsible Parties have monitored sediments and surface waters at the site. The EPA examined the annual sampling results and the 1995 sampling indicated a potential problem in Cohas Brook where the arsenic-contaminated ground water plume discharges to surface water.

The 1986 Endangerment Assessment focussed on lipophilic compounds such as tetrachloroethylene that have a tendency to bioaccumulate in fish tissues. However, lipophilic compounds are either not present, or in extremely low concentrations in the ground water plume. Arsenic does not bioaccumulate to any significant degree in fish or the food chain in particular.[11]

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[10] *Auburn Road Landfill Endangerment Assessment*, Volume 2 of 2, Planning Research Corporation for USEPA, July 1986.

[11] *Ambient Water Quality Criteria for Arsenic*, EPA 440/5-84-033. USEPA Office of Water Regulations and Standards Criteria and Standards Division, Washington, D.C., January 1985.

Sediment sampling in 1995 indicated that one area of Cohas Brook, the area where the site's ground water plume discharges to surface water, had significant concentrations of arsenic. The EPA and Responsible Parties re-sampled this area, and surrounding areas, on July 1, 1996. The results were that no significant mortality was found to occur when test organisms, in this case *Hyalella azteca*, were exposed to the sediments for a ten-day period. The results are discussed in greater detail in Appendix D to this document.

C. Site Risk Summary

No current risk to public health or the environment has been found to exist. There is only future, potential risk posed by the site. The risk is to public health if ground water is used as a drinking water source for an extended period of time (30 years). The drinking water risks are quantified in Section VI (A) of this document.

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment. In particular, the future, potential ingestion of arsenic-contaminated ground water would represent an unacceptable risk to human health.

VII. DEVELOPMENT AND SCREENING OF ALTERNATIVES

A. Statutory Requirements/Response Objectives

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that are protective of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences, including: a requirement that EPA's remedial action, when complete, must comply with all federal and more stringent state environmental standards, requirements, criteria or limitations, unless a waiver is invoked; a requirement that EPA select a remedial action that is cost-effective and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and a preference for remedies in which treatment which permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances is a principal element over remedies not involving such treatment. Response alternatives were developed to be consistent with these Congressional mandates.

Based on preliminary information relating to types of contaminants, environmental media of concern, and potential exposure pathways, remedial action objectives were developed to aid in the development and screening of alternatives. These remedial action objectives were developed to mitigate existing and future potential threats to public health and the environment. In 1989 EPA chose response objectives for soil and ground water. Briefly, those objectives were to provide protection of public health risk from contaminated ground water, reduce environmental risks from contaminated surface waters, and to reduce the public health risk from ingestion of contaminated soil. These goals are enumerated on page 17 of the 1989 ROD and are detailed fully in Section 2 of the 1989 Feasibility Study. No exposure pathway exists for drinking water consumption nor soil ingestion due to the supplied public water system and limited contamination in ground water and the landfill cap covering contaminated soil, respectively. Therefore EPA chooses, as response objectives in the 1996 Record of Decision:

1. Ensure that ground water discharge from the site does not degrade the environment nor create a health risk for those people who wade or swim in surface waters near the site.

2. Ensure that ground water is not used as a source of drinking water and that progress is made towards achieving cleanup levels.

3. Maintain the effectiveness of the landfill cap and the drainage structures to eliminate or reduce ground water infiltration through the landfilled areas.

B. Technology and Alternative Development and Screening

CERCLA and the National Contingency Plan (NCP) set forth the process by which remedial actions are evaluated and selected. In accordance with these requirements, a range of alternatives were developed for the site. These alternatives, and the technical basis that underlie them are developed in the April

1996 Feasibility Documentation.[12]

This Amended Record of Decision addresses ground water cleanup. The Source Control actions proposed in the 1989 Record Of Decision have been implemented. Circumstances have combined to change the character of ground water contamination to require a re-examination of the means to remedy that contamination. As previously noted, an entire class of contaminants has almost disappeared from the site. Therefore, the EPA determined that a re-examination of the ground water remedy was necessary. This re-examination is summarized in an April 1996 Feasibility Supplement to the 1989 Feasibility Study.

With respect to the chosen response action, the 1989 and 1996 Feasibility Studies developed a number of remedial alternatives and a limited action alternative. The 1989 Feasibility Study and the 1996 Feasibility Documentation identified, assessed and screened technologies based on implementability, effectiveness, and cost. The EPA compared present site conditions against the ability of the alternatives selected in the 1989 to address conditions within the arsenic-contaminated aquifer. The EPA also investigated the potential of new, innovative technologies to address contaminated ground water. No technology, neither established nor innovative, was found that either the EPA or the State believed was capable of achieving cleanup levels for arsenic any faster than capping the disposal areas and allowing natural attenuation to occur as proposed for the limited action alternative. The EPA expects that the limited action, natural attenuation remedy, will restore ground water within a reasonable time frame. Other than the limited-action alternative, the EPA developed technologies that may achieve cleanup levels, temporarily, and in localized areas. The EPA believes that the limited action alternative will achieve protective cleanup levels in the same time frame as any other remedy.

The NCP, 40 CFR Part 300 Section 300.430(e)(3) & (4) identifies a method to develop a range of remedial alternatives to address contamination at the site. The 1989 Feasibility Study and the 1996 Supplement present the remedial alternatives

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[12] *Feasibility Documentation, Supplement to 1989 Auburn Road Feasibility Study*, US Environmental Protection Agency, April 1996.

developed by combining the technologies identified in the screening process identified the NCP. The initial screening narrowed the number of potential remedial actions for further detailed analysis while preserving a range of options. The remedial actions were assembled as alternatives and then each alternative was then evaluated and screened in Chapter 4 of the 1989 Feasibility Study and in the 1996 Supplement.

In summary, one remedy that could be termed a source control measure, one remedy that could be termed a management of migration measure, and the limited action remedial alternative were retained for consideration.

VIII. DESCRIPTION OF ALTERNATIVES

This Section provides a narrative summary of each alternative evaluated. A detailed assessment of each alternative can be found in Appendix C attached to this document. The area of contamination consists of a narrow plume of arsenic contaminated ground water that flows northward from the site. The area is Class II ground water, that is it is a potential source of drinking water in New Hampshire. Surface waters in the area are classified as "B", that is suitable for recreational purposes, by the State.[13]

All three alternatives will restore ground water to drinking water standards off-site and on-site. Preliminary modeling shows that natural attenuation should achieve cleanup levels for arsenic, off-site, within five years. A narrow plume of arsenic-contaminated ground water flows off-site to the north of the disposal areas. Institutional controls, either deed restrictions or implementation of New Hampshire's Groundwater Protection Rules Env-Ws 410, will be necessary for all alternatives to prohibit the use of contaminated ground water for drinking water purposes.

The three alternatives to address arsenic contaminated ground water are:

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[13] Thomas Andrews, verbal communication with Darryl Luce, May 29th, 1996.

Alternative 1: Limited Action.

The key component of this, and the other alternatives, is the landfill cap that the Town of Londonderry constructed as a Source Control measure. The Source Control measure, listed as Alternative SC-2 in the 1989 Record of Decision, featured construction of a synthetic cap on the landfilled areas and drainage improvements to lower the water table. The cap and drainage improvements were completed in 1994.

The cap and water table lowering will either effectively eliminate or diminish the flow of contaminants from the landfilled areas into the watertable. Ground water modeling has shown that the arsenic in ground water should meet cleanup levels off-site within five years of the installment of the cap.[14] Therefore, the EPA expects that cleanup levels will be attained within a reasonable time frame. The ground water discharges to surface water; however, based on sampling results, the arsenic does not appear to discharge to surface waters. It appears that when the arsenic-contaminated ground water nears the stream-bottom, oxygen-rich water contacts the up-welling contaminated water, changing the chemistry and causing the iron and arsenic to precipitate before discharging to the ponds and streams.

Under this alternative only ground water, surface water, sediment, and air sampling would occur. This sampling would be evaluated periodically to determine if a risk to human health or the environment occurs, or if conditions within the aquifer require re-evaluation, or if the sampling program requires adjustment. The goals of the sampling program will be to:

- ensure that the public is not exposed to unacceptable concentrations of site contaminants in either surface waters or sediments;

- ensure that any contaminants in surface water and sediments in water bodies surrounding the site are not present in concentrations or forms

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[14] *Supplement II, Updated Solute Transport Model Simulations, Auburn Road Landfill Site...*, Sevee & Maher Engineers, March 4, 1994.

that are toxic to aquatic life; and

- determine progress in the cleanup of the aquifer.

If the EPA and the State identify a problem, additional investigations would be performed to determine the full nature of the problem. The EPA and the State would use those investigations to determine what the risk is, where the problem originates, and the possible response actions. Prior to implementing any actions, the EPA and the State would discuss investigation results, their conclusions, and any recommendations with the public.

EPA and the State would also require institutional controls to prevent someone from using ground water that may be contaminated. The institutional controls will be instituted through either deed restrictions or municipal land use restrictions. After five years EPA and the State would evaluate how well this remedy protects the public health and environment.

While Alternative 1 is similar to Alternative MM-1 in the 1989 Proposed Plan and Record of Decision, one significant difference in the current proposal is in how quickly the ground water will be cleaned. In the 1989 ROD, the EPA estimated that it would take 30 years for the ground water to be restored to drinking water quality. However, natural attenuation has reduced the majority of the VOC contaminants to concentrations below the 1989 ROD cleanup levels and only arsenic remains. Ground water modeling indicates that the time to achieve cleanup levels off-site is 5 years from when the cap was placed on the landfill. Because waste will remain on-site, monitoring costs were calculated for over a thirty-year period.

The limited action alternative relies on the proper functioning of the landfill cap and the drainage improvements. The action taken will ensure that the natural processes that have prevented the public's contact with arsenic-contaminated ground water will continue to occur. Currently, natural processes appear to be functioning to eliminate any arsenic discharges to surface water. Applicable and relevant and appropriate requirements (ARARs) will include some substantive portions of the State of New Hampshire's *Groundwater Protection Rules*, Env-Ws 410, February 1993 and *Surface Water Quality Regulations*, Env-Ws 430 - 438, September 30, 1996. New Hampshire's *Water Quality Standards*, Env-Ws 310 -

319 and *Surface Water Quality Regulations* replace the Federal Safe Drinking Water Act and Clean Water Act, respectively, because these Federal programs have been delegated to the state. Federal ARARs will include the Fish and Wildlife Coordination Act, 40 CFR 6.0302(g), and Executive Order 11990, Protection of Wetlands, 40 CFR 6, Appendix A. There will be no residuals nor implementation requirements.

Estimated Period of Operation: **5 years**
Estimated Total Cost: **$2,000,000**

Alternative 2: On-Site Treatment by Extraction and Chemical Precipitation.

This was chosen as "EPA's preferred alternative" for ground water cleanup in the 1989 Proposed Plan. In this alternative, contaminated ground water would be collected in wells and trenches. The contaminated water would be pumped to a central facility for chemical precipitation to remove metals. The solvent compounds have largely disappeared eliminating the need for an air stripper. A monitoring program, similar to that outlined for Alternative 1, would be implemented under this alternative.

To remove metal contaminants, such as iron and arsenic, established precipitation and settling technologies would be employed to precipitate and settle out metal contaminants. The resulting sludges would be further compacted in a filter press. The resulting filtrate would be tested and disposed of properly.

Any traces of volatile organic compounds that may occur would be removed from the ground water by liquid-phase carbon. The treated water would meet drinking water standards for metals and solvent compounds. The clean ground water would then be recharged back into the aquifer through recharge trenches.

The pump and treat alternative would locally recover arsenic-contaminated ground water and remove the arsenic. The pump and treat remedy may limit migration; however, it is believed that it will not stop arsenic from entering the ground water. Therefore, it is expected that the optimum result will be localized reductions of arsenic; however, arsenic will still exceed 50 parts per billion in the majority of the aquifer. Applicable and relevant and appropriate requirements (ARARs) will include the ARARs identified in alternative 1 and also New Hampshire's *Hazardous Waste Rules*, Env-Ws 100 - 1000 which replaces Federal hazardous waste rules under the Resource Conservation and Recovery Act (RCRA) because the state has been delegated that program. Construction of a ground water treatment plant and the installation of wells will be required.

***Estimated Time to Construct:* 1 to 2 years**
***Estimated Time of Operation:* 3 to 5 years**
***Estimated Total Cost:* $12,500,000 to $16,300,000**

Alternative 3: Excavate the Landfills, Build a New Landfill On Site with a Baseliner and Cap.

In the 1989 Feasibility Study and Record Of Decision this was Source Control remedy SC-4. This alternative proposes to completely encapsulate the landfill to eliminate all leaching from the landfill. Such encapsulation would require an impermeable baseliner beneath the landfill in addition to the existing top cap. Because a baseliner cannot be placed under an existing landfill, the implementation of this alternative would require that all of the existing waste be dug up, a new disposal area be constructed with a base-liner, and the waste re-deposited into the new landfill area. This would require construction of a new area, installing a new baseliner, and then excavating and moving the old waste to the new landfill area. Some of the excavated waste would require treatment to remove contaminants. Such treatment would be through low-temperature thermal stripping. Once all waste was placed in the new area, the new landfill would be capped much as it is now. A monitoring program, similar to that outlined for Alternative 1, would also be implemented under this alternative.

Construction of a new landfill would require approximately 240,000 cubic yards of materials to be excavated and moved. It was estimated in the 1989 Feasibility Study that approximately 40,000 cubic yards of contaminated soil would need to be treated to reduce contamination present. Applicable and relevant and appropriate requirements include those ARARs identified for alternatives 1 and 2, Federal Land Disposal Regulations 40 CFR 268, additional portions of the New Hampshire's Hazardous Waste Rules, the Federal Clean Air Act and, New Hampshire Air Quality Rules (RSA Chapter 125-C).

***Estimated Time to Construct:* 1 to 2 years**
***Estimated Time of Operation:* 3 to 4 years**
***Estimated Total Cost:* $32,400,000**

EPA developed the above alternatives based on information contained in the 1989 Feasibility Report prepared by R.F. Weston, Inc. EPA presented these alternatives as alternatives MM-1, MM-2 and SC-4, respectively, in the 1989 Proposed Plan and Feasibility Study. Despite the shortened cleanup times for all of the remedies, it should be noted that because it is a landfill and regardless of the remedy, it will still be necessary to monitor ground water for 30 years.

IX. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

Section l2l(b)(1) of CERCLA presents several factors that at a minimum EPA is required to consider in its assessment of alternatives. Building upon these specific statutory mandates, the National Contingency Plan articulates nine evaluation criteria to be used in assessing the individual remedial alternatives.

A detailed analysis was performed on the alternatives using the nine evaluation criteria in order to select a site remedy. The following is a summary of the comparison of each alternative's strength and weakness with respect to the nine evaluation criteria. These criteria are summarized as follows:

Threshold Criteria

The two threshold criteria described below must be met in order for the alternatives to be eligible for selection in accordance with the NCP.

1. **Overall protection of human health and the environment** addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.

2. **Compliance with applicable or relevant and appropriate requirements (ARARS)** addresses whether or not a remedy will meet all of the ARARs of other Federal and State environmental laws and/or provide grounds for invoking a waiver.

<u>Primary Balancing Criteria</u>

The following five criteria are utilized to compare and evaluate the elements of one alternative to another that meet the threshold criteria.

3. **Long-term effectiveness and permanence** addresses the criteria that are utilized to assess alternatives for the long-term effectiveness and permanence they afford, along with the degree of certainty that they will prove successful.

4. **Reduction of toxicity, mobility, or volume through treatment** addresses the degree to which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the site.

5. **Short term effectiveness** addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until cleanup goals are achieved.

6. **Implementability** addresses the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

7. **Cost** includes estimated capital and Operation Maintenance (O&M) costs, as well as present worth costs.

Modifying Criteria

The modifying criteria are used on the final evaluation of remedial alternatives generally after EPA has received public comment on the RI/FS and Proposed Plan.

8. **State acceptance** addresses the State's position and key concerns related to the preferred alternative and other alternatives, and the State's comments on ARARs or the proposed use of waivers.

9. **Community acceptance** addresses the public's general response to the alternatives described in the Proposed Plan and RI/FS report.

A detailed tabular assessment of each alternative according to the nine criteria and an assessment of the relative performance of each alternative against the nine criteria is attached as a portion of Appendix C to this ROD. The section below presents the nine criteria and a brief narrative summary of the alternatives and the strengths and weaknesses according to the detailed and comparative analysis.

1. Overall Protection of Human Health and the Environment

This criteria considers whether an alternative, as a whole, will protect human health and the environment. This includes an assessment of how public health and environmental risks are properly eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

There are two primary considerations at this site: the first is that contaminated ground water does not discharge to surface water in concentrations sufficient to pose a risk to human health or the environment, and the second is that no one is drinking contaminated ground water. Therefore, there is no present exposure to site contaminants under any of the alternatives. Because the time to attain cleanup levels is dependent upon the rate of flow of contaminants from the landfill, which should diminish due to the cap, the time to attain cleanup levels, and comply with all ARARs, is the same for all three alternatives.

There are no exposures to contaminants in concentrations sufficient to pose a risk at the site to either the public health or the environment. Therefore, all three alternatives are equally protective of human health and the environment.

2. Compliance with Applicable and Relevant and Appropriate Regulations

Addresses whether or not a remedy complies with all state and federal environmental and public health laws and requirements that apply or are relevant and appropriate to the conditions and cleanup alternatives at a specific site. If an Applicable or Relevant and Appropriate Requirement (ARAR) cannot be met, the analysis of the alternative must provide the grounds for invoking a statutory waiver.

All of the alternatives will meet the requirements of all ARARs within a reasonable time frame. The only ARARs the site is not in compliance with are the chemical specific ARARs that pertain to drinking water standards.

The period over which any of the remedial alternatives will achieve compliance with all of the chemical-specific ARARs will be in approximately the same time frame. Arsenic in ground water violates the drinking water standard, if ground water were used as a drinking water source. Based on the results of ground water modeling, EPA expects that contaminants leaching from the landfilled areas will diminish due to the caps and that ground water will meet cleanup levels off-site within five years. The EPA believes that ground water will meet cleanup levels in a reasonable time frame, therefore there is no need to invoke an ARAR waiver for ground water cleanup. Pumping and treating contaminated ground water will not hasten the cleanup process because the contamination is dependent upon leaching from the landfill. The cleanup levels established in the 1989 Record of Decision are essentially met for all compounds other than arsenic.[15]

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[15] *Methods for Evaluating the Attainment of Cleanup Standards,* Volume 2: Ground Water. United States Environmental Protection Agency, Policy, Planning and Evaluation, EPA 230-R-92-014. July 1992.

3. Long-term Effectiveness and Permanence

Refers to the ability of an alternative to maintain reliable protection of human health and the environment over time once the remedial action objectives and cleanup levels have been met.

Alternatives 1, 2, and 3 will be equally effective and permanent. They will be equally effective in maintaining risk levels because they rely on the flow of contaminants from the landfill to be reduced due to the existing landfill cap. The landfill cap will minimize infiltration, lessening ground water and contaminant flow from the landfills, and permanently reduce the risk. The rebound of contaminant concentrations occurs usually after the cessation of a remedy because of disequilibrium conditions imposed such as pumping. However, if cleanup levels are attained through natural attenuation, the remedy will be permanent because equilibrium conditions will have been maintained and the natural process will have exhausted itself. Alternative 2 may reach cleanup levels more quickly than alternative 1; however, it is very likely that arsenic concentrations will rebound once pumping is stopped. Neither alternatives 2 or 3 will attain cleanup levels through its implementation alone. Natural attenuation, assisted by the capping of the landfill will ensure the effectiveness and the permanence once cleanup levels are attained.

4. Reduction of Toxicity, Mobility, and Volume through Treatment

These are the three principle criteria of the overall performance of an alternative. The 1986 amendments to the Superfund statute emphasizes that, whenever possible, EPA should select a remedy that uses a treatment process to permanently reduce the level of toxicity of contaminants at the Site, inhibit or eliminate the spread of contaminants away from the source of contamination, and reduce the volume, or amount, of contamination at the Site.

All three alternatives reduce mobility through the use of a landfill cap, although Alternative 2 also uses hydraulic controls. Toxicity and volume are diminished by all three alternatives by capping the disposal areas, thereby reducing infiltration and leaching of contaminants from the aquifer. Alternative 3, encapsulation, should be more effective in reducing mobility through the use of a baseliner and the treatment of any wastes encountered during excavation.

The potential exists for Alternative 2, pump-and-treat, to reduce toxicity, mobility, and volume through treatment. However, it is believed that any such effects may be short-lived. Once pump-and-treat draws down the aquifer, the mobility of any contaminants leaching from the landfill will be zero, or nearly so. The contaminants will be trapped above the water table until the recovery system is turned off. The water table will then rebound and contaminant flow will resume. A small scale pump-and-treat, designed solely to intercept a contaminant plume, may limit migration but would not cleanup the aquifer.

5. Short-term Effectiveness

Refers to the likelihood of adverse impacts on human health or the environment that may be posed during the construction and implementation of an alternative until remedial action objectives and cleanup levels are achieved.

Short-term effectiveness addresses the risks posed to workers and neighbors during the construction and implementation of the remedy. In this regard, Alternatives 1 and 2 would meet this criteria without much difficulty. The risks that each poses over its construction or implementation can be easily managed. However, Alternative 3 has the potential to pose significant short-term risks to workers and the neighborhood. Engineering controls for Alternative 3 should be able to minimize the potential risks that may be present. The excavation and re-internment of wastes proposed for Alternative 3 will occur over two years. The potential exists for fugitive gases or contaminant-bearing dusts to escape the control measures during that time.

The potential for impact to wetlands exists for all three alternatives. All three alternatives could see the potential for ground water to produce either violations of surface water quality standards or potentially harmful effects to wildlife due to sediment exposure during the time period in which contaminated ground water flows to surface water bodies. The potential also exists for significant impacts to wetlands during the implementation of Alternative 3, encapsulation, due to erosion or runoff during the excavation.

6. Implementability

Refers to the technical and administrative feasibility of an alternative, including the availability of materials and services needed to implement the alternative.

All alternatives use technologies that are standard. The sampling and analysis, and maintenance of the cap, will need to be implemented for all three alternatives. Alternative 3 is the most cumbersome of the alternatives and would require years to implement. The construction of Alternatives 2 and 3 would require careful planning and work, and both alternatives would require at least one-year for design and one to two years for construction. For all three alternatives, long-term monitoring of ground water and surface water will necessitate administrative measures to ensure proper sampling and analysis. Long-term management of the data will also be necessary to be able to track progress in the cleanup at the site or identify problems. Obtaining institutional controls will also be required.

7. Cost

Includes the capital (up-front) cost of implementing an alternative as well as the cost of operating and maintaining the alternative over the long-term, and net present worth of both capital and operation and maintenance costs.

The EPA has developed the costs using reasonable assumptions more fully outlined in the Feasibility Study. However, the comparison for implementing each remedy and monitoring over 30 years is:

Alternative 1:	**$ 2,000,000**
Alternative 2:	**$12,500,000 to $14,300,000**
Alternative 3:	**$32,800,000**

CONCLUSION AFTER ANALYSIS OF SEVEN OF THE CRITERIA

The comparison of the three alternatives to one another led EPA to select Alternative 1 for presentation to the public as EPA's preferred alternative during the public participation process and in the Proposed Plan. The EPA selected this remedy because under Alternative 1 public health and the environment are protected, ground water modeling indicates that cleanup levels and ARARs will be met within a reasonable time frame, no active remedy will restore the aquifer any faster than natural attenuation, and a source of public drinking water is supplied to the affected area.

8. State Acceptance

Addresses whether, based on its review of the data derived from the Site and the Proposed Plan, the State concurs with, opposes, or has no comment on the alternative EPA has selected as the remedy for the Site.

The State recommends Alternative 1 based on a similar, although independent, analysis of the above seven criteria. The New Hampshire Department of Environmental Services has provided EPA with a letter of concurrence with the selected remedy. This letter is attached as Appendix A.

9. Community Acceptance

Addresses whether the public concurs with EPA's Preferred Alternative. Community acceptance of this cleanup proposal was evaluated based on comments received at the public hearing.

Representatives of the community and some of the residents support Alternative 1 after presentation at the public meeting. Some residents, including some who abut the site, did express concern regarding incidental exposure to children in some of the surface water bodies in the area. Two residents, one an abutter to the site, are ardently opposed to Alternative 1 and instead request that EPA consider Alternative 2, pump and treat, or, preferably, Alternative 3, encapsulation.

X. THE SELECTED REMEDY

Alternative 1 is the selected remedy based on the following:

- no current unacceptable risk is posed to public health or the environment;
- the remedy will attain cleanup levels and will meet all ARARs within a reasonable time frame;
- the remedy will be permanent;
- past activities have acted to reduce mobility and toxicity;
- the remedy will pose no short-term risks; and
- the cost is much less over the other alternatives, yet cleanup levels will be attained in approximately the same time frame with identical residual levels.

Combined with the source control remedy that the Town finished in 1994, the landfill cap and drainage improvements, Alternative 1 will provide for a comprehensive remedy. Alternative 1, the Limited Action remedy consists of maintaining the existing landfill cap and drainage system, establishing institutional controls, and implementing an environmental monitoring plan. Institutional controls will prevent the use of contaminated ground water for drinking water purposes in the present and future. Municipal drinking water is already supplied to the area. An environmental monitoring plan will look at ground water, surface water, sediment, and the air. Ground water modeling has shown that natural attenuation should attain cleanup levels off-site in five years.

A. Interim Cleanup Levels

Interim cleanup levels that are being established as the performance standards for this remedy are ground water quality standards. Once the interim cleanup levels are attained and all ARARs are complied with over a three-year period a risk assessment will be performed. The risk assessment will determine if conditions both on-site and off-site are such that no current or future risk is posed to either the public health or the environment for any exposure pathway. The protective residual levels, as determined through that risk assessment, will be the final cleanup levels for this Record of Decision and shall be considered the performance standards for this remedial action. The interim cleanup levels established under this Record of Decision are only for ground water and are presented in Table 7.

Interim cleanup levels were established in the 1989 ROD for ground water for all contaminants of concern identified in the Baseline Risk Assessment found to pose an unacceptable risk to either public health or the environment. The cleanup levels for the nine contaminants have been retained, with one exception, in this Amended Record of Decision despite the fact that four compounds are below the cleanup levels and three compounds are within EPA's acceptable risk range. The cleanup level for toluene has been lowered from 2,000 parts per billion (ppb) to 1,000 ppb to reflect the changes in regulations and to be in conformance with the State of New Hampshire's Drinking Water Standards. Interim cleanup levels were set based on the ARARs (e.g., Drinking Water Maximum Contaminant Level Goals (MCLGs) and MCLs) as available, or other suitable criteria described below.

Periodic assessments of the protection afforded by the selected remedy will be made as the remedy is being implemented and at the completion of the remedial action. At the time that Interim Ground Water Cleanup Levels identified in the Amended ROD and newly promulgated ARARs and modified ARARs which call into question the protectiveness of the remedy have been achieved and have not been exceeded for a period of three consecutive years, a risk assessment shall be performed on the residual ground water contamination to determine whether the remedial action is protective. This risk assessment of the residual ground water contamination shall follow EPA procedures and will assess the cumulative carcinogenic and non-carcinogenic risks posed by:

- the ingestion and dermal absorption of arsenic from surface water and sediments; and

- the ingestion of ground water used for drinking water purposes.

If, after review of the risk assessment, the remedial action is not determined to be protective by EPA, the remedial action shall continue until either protective levels are achieved, and are not exceeded for a period of three consecutive years, or until the remedy is otherwise deemed protective. These protective residual levels shall constitute the final cleanup levels for this Record of Decision and shall be considered performance standards for any remedial action.

Because the aquifer at and beyond the compliance boundary for the landfill is a Class II aquifer which is a potential source of drinking water, MCLs established under New Hampshire's Water Quality Standards are ARARs.

Interim cleanup levels for known, probable, and possible carcinogenic compounds (Classes A, B, and C, respectively) have been established to protect against potential carcinogenic effects and to conform with ARARs. Interim cleanup levels for Class D and E compounds (not classified, and no evidence of carcinogenicity) have been established to protect against potential non-carcinogenic effects and to conform with ARARs.

In the absence of a MCL, other suitable criteria were considered (i.e., health advisory, state guideline). In the absence of the above standards and criteria, interim cleanup levels for all other compounds (Classes D and E) were established based on a level that represent an acceptable exposure level to which the human population including sensitive subgroups may be exposed without adverse affect during a lifetime or part of a lifetime, incorporating an adequate margin of safety (hazard quotient = 1) considering the ingestion of ground water or the ingestion and dermal exposure to arsenic-contaminated surface water. If a value described by any of the above methods was not capable of being detected with good precision and accuracy or was below what was deemed to be the background value, then the practical quantification limit or background value was used as appropriate for the Interim Cleanup Level.

The Table on the following page summarizes the Interim Cleanup Levels established in the 1989 Record of Decision. This Amended Record of Decision will retain those cleanup levels. Within Table 6 a number of compounds, other than arsenic, exceed cleanup levels. Vinyl chloride, trichloroethylene, tetrachloroethylene, and benzene exceed the cleanup levels in only one well, MW-102A. Well MW-102A is directly adjacent to the Old Town Dump, down-gradient from this well the contaminants are naturally attenuated and are not detected. Although the concentrations for trichloroethylene and tetrachloroethylene are significantly over their cleanup levels in MW-102A the maximum risk posed by those concentrations in drinking water is within EPA's acceptable risk range ($5x10^{-4}$

to 1 x 10^{-6}). Benzene and vinyl chloride barely exceed their cleanup level in MW-102A and the risk for drinking water is within EPA's acceptable risk range. Vinyl chloride is a degradation product of trichloroethylene and other chlorinated hydrocarbons, therefore vinyl chloride is likely to be seen in well MW-102A where trichloroethylene and other compounds are degrading. Vinyl chloride had not been found to exceed its cleanup level in any wells outside of the site property boundary.

TABLE 6 - INTERIM CLEANUP LEVELS IN GROUND WATER					
Contaminant	BASIS	CLEANUP LEVEL (parts per billion)	1995 CONCENTRATIONS (in parts per billion)		NUMBER OF WELLS EXCEEDING CLEANUP LEVEL
			AVERAGE	MAXIMUM	
Vinyl Chloride	MCL	2	0.5	6	1 out of 15
trans 1,2 Dichloroethylene	MCL	70	0.4	6	0 out of 14
2-Butanone	Health Advisory	172	0.9	6	0 out of 15
Trichloroethylene	MCL	5	only one well detect	44	1 out of 15
Tetrachloroethylene	PMCL	5	only one well detect	100	1 out of 15
Toluene	MCL	1,000	1.1	6	0 out of 15
Benzene	MCL	5	0.9	6	1 out of 15
Arsenic[16]	MCL	50	74.2	354	19 out of 37
Lead	MCL ACTION LEVEL	50 15	Lead has not exceeded cleanup levels or Action Levels.		

16 Recent studies indicate that many skin tumors arising from oral exposure to arsenic are non-lethal and that the dose-response curve for the skin cancers may be sublinear (in which case the cancer potency factor used to generate risk estimates may be overestimate). It is Agency policy to manage these risks downward by as much as a factor of ten. As a result, the carcinogenic risk for arsenic at this Site has been managed as if it were one order of magnitude lower than the calculated risk. Consequently, the risk level for arsenic in Table 2 reflects a risk management factor.

These interim cleanup levels are consistent with ARARs or suitable TBC criteria for ground water, attain EPA's risk management goal for remedial actions and are determined by EPA to be protective. However, the true test of protection cannot be made until residual levels are known. Consequently, at the time that Interim Ground Water Cleanup Levels identified in the ROD and newly promulgated ARARs and modified ARARs which call into question the protectiveness of the remedy have been achieved and have not been exceeded for a period of three consecutive years, a risk assessment will be performed on residual ground water contamination to determine whether the remedial action is protective.

A risk assessment of the residual ground water contamination shall follow EPA procedures and will assess the cumulative carcinogenic and non-carcinogenic risks posed by future ground water consumption as drinking water. If, after review of the risk assessment, the remedial action is not determined to be protective by EPA, then remedial actions shall continue until either protective levels are achieved and are not exceeded for three consecutive years or until the remedy is otherwise deemed protective. These protective residual levels shall constitute the final cleanup levels for this Record of Decision and shall be considered performance standards for any remedial action.

All Interim Cleanup Levels identified in the Amended ROD and newly promulgated ARARs and modified ARARs which call into question the protectiveness of the remedy and protective levels determined as a consequence of the risk assessment of residual contamination, must be met at the completion of the remedial action. The EPA has estimated that these levels will be obtained within five years after completion of the source control component.

B. Description of Remedial Components

The selected remedy, Alternative 1, consists of operating and maintaining the existing Site controls to achieve the natural restoration of the ground water and to protect surface water quality. This alternative will prevent the public from using contaminated ground water for drinking water purposes, will meet, through natural processes, cleanup levels in ground water, and act to address any contamination in ground water, surface water, or sediments that threaten public health or the environment. The selected remedy consists of the following remedial components:

1. Natural Attenuation of Contaminated Ground Water

Restore ground water to meet final cleanup levels and meet all ARARs through natural attenuation. Contaminated ground water flows to the north as shown on Figure 5 on page 22. There shall be no degradation of ground water quality such that cleanup levels or ARARs are violated outside of the area of contamination. Ground water flow is to the north and ultimately discharges to Cohas Brook. Therefore, no degradation of ground water, due to the site, shall be allowed to the north of Cohas Brook.

2. Establishment of a Ground Water Management Zone ("GMZ...")

The selected remedy essentially adopts the process established under New Hampshire's Ground water Protection Rules for providing a temporary exemption from ground water quality standards within a zone of non-compliance. This process involves establishment of a Ground water Management Zone (GMZ) which in combination with establishment of institutional controls within the GMZ will allow for protection of public health while the other components of the natural attenuation remedy are implemented. However, cleanup levels also will be achieved within the GMZ within a reasonable time frame. A monitoring program will be established within the Long Term Monitoring Plan that will allow the EPA and the State to determine the effectiveness of the remedy over time. Data generated through the Long Term Monitoring Plan will be evaluated for each five-year review; however, annual assessments of the data and cleanup progress will be performed. If ground water quality standards are exceeded outside the GMZ or if surface water quality is affected, or if sediments are found to be significantly toxic to test organisms, modifications to the remedy may be required to address the restoration of ground water outside the GMZ and/or restoration of surface water quality.

The Scope of Work (SOW) for remedial design and remedial action will address what information must be submitted for establishment of the GMZ and will establish the schedule for compliance with performance standards.

3. Implementation of Long Term Monitoring Plan

A detailed plan for monitoring the performance and effectiveness of the remedial action will be developed and submitted to the state and EPA for approval during the remedial design phase of the remedial response. The ground water monitoring component of the plan will provide the data necessary to monitor the effectiveness of the existing site controls and the natural attenuation component of the remedy. The surface water/sediment component of the plan will also provide data necessary to determine the effectiveness of existing site controls or whether contaminated ground water is impacting surface water or migrating beyond the compliance boundary, thereby necessitating modification to the remedial components.

If the monitoring program detects significant events, additional investigation will be performed. Significant events are:

a. Ground water contaminated by the site moves northward, in either the bedrock or overburden aquifers from Cohas Brook. These events would be detected either by a well established for such monitoring or surface seeps. Such an event would indicate that the arsenic contaminated plume has migrated past the compliance boundary.

b. A violation of the surface water standards contained in New Hampshire's *Surface Water Quality Regulations* Env-Ws 430 - 438 for the compounds with cleanup levels listed in this, and the 1989, Record of Decision in either Whispering Pines Pond or Cohas Brook. The specific cases that are significant events are:

1. Surface water quality violations occur if arsenic concentrations in Cohas brook or Whispering Pines Pond are significantly elevated over the up-gradient samples or if arsenic concentrations exceed the standards contained in Env-Ws 430 - 438. The arsenic standards for Freshwater (acute) are 850 ppb for pentavalent arsenic (As^{5+}) and 360 ppb for trivalent (As^{3+}). The standards for

freshwater (chronic) are 48 ppb for pentavalent arsenic and 190 for trivalent..

2. Surface water quality standards for vinyl chloride - 2 parts per billion (ppb), trichloroethylene - 5 ppb, benzene - 5 ppb, and tetrachloroethylene - 0.8 ppb are exceeded.

3. If arsenic contaminated sediments are found to be toxic to aquatic life.

If data show evidence that any one of the criteria in Section X. B. 3. a. & b. may be violated, a plan of action will be developed that describes what investigatory actions will be taken to determine if a problem exists and the magnitude of that problem. The results of the investigatory action will be used to determine if additional sampling or remedial action is necessary. If the established standards contained within the ARARs are violated, or if an unacceptable risk is posed to either public health or the environment, a plan of action will be developed that outlines how the problem creating those conditions will be corrected. That plan will be brought before the public for review and comment before implementation.

The EPA and State will review all sampling data as it becomes available and conduct a comprehensive review on an annual basis. Annual meetings will be held to apprise the public of what risk the site may pose at that time.

4. Maintenance of Existing Site Controls (cap and drainage system)

The landfill cap maintenance plan, which is already in place and is being implemented by the town, will continue to be implemented as (O&M).[17] The O&M plan includes procedures for maintaining the integrity of the cap, including inspections for determining areas of erosion or failure of the cap. It

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[17] *Post-Closure Operations and Maintenance Plan, Auburn Road Landfill Superfund Site, Source Control Remedial Action,* Prepared for the Town of Londonderry by SEA Consultants Inc., February 1995, Revised May 1996.

also requires monitoring of internal landfill gases to ensure that concentrations of methane and other gases do not pose a risk to health or the environment.

The O&M plan also includes procedures for maintenance of the drainage components to ensure that ground water contacts the smallest possible amount of landfilled volume. This includes periodic inspections to determine if water is able to flow freely from the area surrounding the landfills. Ground water is also measured to determine if the water table is contacting waste in the landfilled areas.

5. Establishment of Institutional Controls

Institutional controls will be established to provide notice and to restrict use of contaminated ground water within the GMZ. The notice and recordation portions of the state's ground water statutes and rules are ARAR's, so that recordation notice or notice through municipal land controls will be provided to affected persons. Restrictions on use of ground water through easement or ownership will also be established.

6. Five Year Reviews

The 1986 CERCLA amendments require review of conditions every five years at NPL sites if any hazardous substances, pollutants or contaminants remain to assure that the remedial action continues to protect human health and the environment.. All data obtained in the monitoring program, and evaluated on an annual basis, will be further evaluated in the five-year reviews. These reviews will consider all relevant data, any significant trends, and determine if additional remedial actions, adjustment to the monitoring plan, or other actions, are necessary.

The criteria established in the SOW will provide the basis for determining whether the remedial components should be modified.

XI. STATUTORY DETERMINATIONS

The remedial action selected for implementation at the Auburn Road Landfill Superfund Site is consistent with CERCLA and, to the extent practicable, the NCP. The selected remedy is protective of human health and the environment, attains ARARs and is cost effective. The selected remedy also satisfies the statutory preference for treatment which permanently and significantly reduces the mobility, toxicity or volume of hazardous substances as a principal element. Additionally, the selected remedy utilizes alternate treatment technologies or resource recovery technologies to the maximum extent practicable.

A. The Selected Remedy is Protective of Human Health and the Environment

The remedy at this Site will permanently reduce the risks posed to human health and the environment by eliminating, reducing or controlling exposures to human and environmental receptors through engineering controls and institutional controls; more specifically, allowing natural attenuation to restore ground water to concentrations that are protective while preventing exposure through institutional controls and direct action when necessary.

Moreover, the selected remedy will achieve potential human health risk levels that attain the 10^{-4} to 10^{-6} incremental cancer risk range and a level protective of noncarcinogenic endpoints, and will comply with ARARs and to-be-considered criteria. At the time that the Interim Ground Water Cleanup Levels identified in the ROD and newly promulgated ARARs and modified ARARs which call into question the protectiveness of the remedy have been achieved and have not been exceeded for a period of three consecutive years, a risk assessment shall be performed on the residual ground water contamination to determine whether the remedial action is protective. This risk assessment of the residual ground water contamination shall follow EPA procedures and will assess the cumulative carcinogenic and non-carcinogenic risks posed by drinking ground water. If, after review of the risk assessment, the remedial action is not determined to be protective by EPA, the remedial action shall continue until protective levels are achieved and have not been exceeded for a period of three consecutive years, or until the remedy is otherwise deemed protective. These protective residual levels shall constitute the final cleanup levels for this Record of Decision and shall be considered performance standards for any remedial action.

B. The Selected Remedy Attains ARARs

This remedy will attain all applicable or relevant and appropriate federal and state requirements that apply to the Site. All ARARs for the Site are listed in tabular form in Appendix B, Tables 1 through 3 of this document. Environmental laws from which ARARs for the selected remedial action are derived include:

- New Hampshire *Drinking Water Quality Standards*.
- New Hampshire *Surface Water Quality Rules*
- New Hampshire *Groundwater Protection Rules*
- Federal Fish and Wildlife Coordination Act, 40 CFR 6.0302(g)
- Executive Order 11990 (Protection of Wetlands)

Because no actions are being taken at the site, other than monitoring and cap maintenance, New Hampshire's Hazardous Waste Rules (RCRA Authorized), Executive Order 11988 (Floodplain Management), and New Hampshire's Wetlands Program do not apply. The only air emissions that occur is the passive venting of the landfill gases and the size of the landfill is such that the Clean Air Act does not apply. The RCRA Land Ban requirements do not apply to the selected remedy as no excavation, placement, or disposal of Land Ban waste will occur as a result of the remedial action. The Federal Safe Drinking Water Act and the Clean Water Act are supplanted by the delegated State programs.

The following policies, criteria, and guidance will also be considered (TBCs) during the implementation of the remedial action:

- EPA Health Advisories
- EPA Guidance to Management of Investigation-derived Wastes
- EPA Policy for low-stress sampling

A brief narrative summary of the ARARs and TBCs follows.

CHEMICAL SPECIFIC

New Hampshire *Drinking Water Quality Standards* Maximum Contaminant Levels (MCLs). These are standards for metals, pesticides, VOCs, radionuclides, and other classes of contaminants. The state drinking water program is authorized and these regulations have been adopted as enforceable standards for public drinking water systems identical to the Safe Drinking Water Act (SDWA). MCLs for non-carcinogens are based in part on the allowable lifetime exposure to the contaminant for a seventy kilogram (154 pound) adult who is presumed to consume two liters of water per day. The basic jurisdictional prerequisite for MCLs is that they apply to "public water systems," defined as systems for the provision of piped water for human consumption with at least fifteen service connections. Although not directly applicable to activities at the Site, the potential exists for residential drinking water use of ground water at the Site. Therefore, these standards are considered to be relevant and appropriate.

To attain this requirement, ground water at and beyond the Site will attain MCLs at the completion of the remedy. These levels will be attained by natural attenuation of arsenic and other residual compounds, hastened by the landfill capping and drainage improvements. In the overburden and bedrock aquifers MCLs are expected to be attained off site in approximately five years.

New Hampshire *Surface Water Quality Rules* Water Quality Criteria Water quality criteria relating to surface water are developed under the State's *Surface Water Quality Rules.* They are used by the State of New Hampshire, in conjunction with a designated use for a stream segment, to establish water quality standards. The appropriateness of the WQC guidelines are dependent on site-specific circumstances. These regulations apply to point and non-point sources and include sediments. Ground water discharges to surface water at Cohas Brook and, to a lesser degree, Whispering Pines Pond, therefore AWQC are applicable.

Monitoring will ensure that contaminants do not affect surface water bodies and sediments to the extent to pose a threat to the environment or public health.

New Hampshire *Groundwater Protection Rules* The substantive rules provide quantitative limits on contaminants in ground water and the use of that ground water, regardless of whether it is used as a drinking water source or not. Therefore, these standards are considered to be applicable.

Ground water within and beyond the Site will attain State standards at the completion of the remedy. These levels will be obtained by natural attenuation and hastened by the installation of the landfill cap and the drainage improvements. The time to achieve these standards is expected to be five years.

LOCATION SPECIFIC

There are few location-specific ARARs because there will be no action at the site other than sampling and limited actions. Therefore the only ARARs are:

Federal Protection of Wetlands Executive Order 11990 - 40 CFR Part 6 Appendix A is an applicable ARAR for any discharges of ground water into surface water. In this case the long-term discharge of arsenic-contaminated ground water to surface waters and the creation of an arsenic-bearing sediment will require monitoring to ensure that the sediments do not pose a threat to human health and the environment.

Compliance with the Executive Order will be ensured by ground water, surface water, and sediment monitoring.

Federal Fish and Wildlife Coordination Act - 40 CFR 6.0302(g) which is also an applicable ARAR for any pollutants discharged to surface water from ground water.

New Hampshire *Groundwater Protection Rules* - Env-Ws 410.26 (a - g) establishes a compliance boundary which requires any contamination within the boundary to not migrate outside the compliance boundary and requires that the area within the boundary be restored within a reasonable time frame.

All property owners within the compliance boundary are to be notified through appropriate means and ground water use is to be restricted by ownership, easement, or other appropriate means. These standards are considered to be applicable.

Ground water within and beyond the Site will attain State standards at the completion of the remedy and migration of contaminants will not be allowed to occur. All property owners will be notified of the contamination and the appropriate institutional controls will be established to restrict ground water use.

ACTION SPECIFIC

There are few action-specific ARARs because there will be no action at the site other than sampling and limited actions in some circumstance. Therefore the only ARARs are:

New Hampshire *Groundwater Protection Rules* Portions of these regulations, require that landowners be notified if ground water beneath their properties is unusable due to contamination, and requires that use of that ground water be restricted and an alternative source of drinking water supplied. This requirement is applicable.

Federal Guidance to *Management of Investigation-Derived Wastes* provides guidelines in the handling of contaminated media and equipment. Because this is a guideline it is to-be-considered.

September 23, 1996 Memorandum from Linda Murphy, Director, Office of Site Remediation and Restoration *New Procedure for collecting Ground water samples for the determination of organic and Inorganic contamination* establishes the low-stress method of sampling as the only method to collect valid samples. All ground water samples, with noted exceptions, will be collected using this technique. Because this is a guideline it is to-be-considered.

C. The Selected Remedial Action is Cost-Effective

In the Agency's judgment, the selected remedy is cost effective, i.e., the remedy affords overall effectiveness proportional to its costs. In selecting this remedy, once EPA identified alternatives that are protective of human health and the environment and that attain ARARs, EPA evaluated the overall effectiveness of each alternative by assessing the relevant three criteria in combination:

- long term effectiveness and permanence;
- reduction in toxicity, mobility, and volume through treatment; and
- short term effectiveness,

The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs. The costs of this remedial alternative are approximately $2,000,000 for sampling over a thirty-year period. Although the ground water pump and treat remedy, Alternative 2, is cost effective as well, it was determined that it would not cleanup ground water any faster than Alternative 1 and would cost at least $10,000,000 more.

D. The Selected Remedy Utilizes Permanent Solutions and Alternative Treatment or Resource Recovery Technologies to the Maximum Extent Practicable

Once the Agency identified those alternatives that attain ARARs and that are protective of human health and the environment, EPA identified which alternative utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. This determination was made by deciding which one of the identified alternatives provides the best balance of trade-offs among alternatives in terms of:

1) long-term effectiveness and permanence;
2) reduction of toxicity, mobility or volume through treatment;
3) short-term effectiveness;
4) implementability; and
5) cost.

The balancing test emphasized:
long-term effectiveness and permanence; and
the reduction of toxicity, mobility and volume through treatment.
The balancing test considered as principle elements:
the preference for treatment;
the bias against off-site land disposal of untreated waste; and
community and state acceptance.

The selected remedy provides the best balance of trade-offs among the alternatives.

Although generally a preference for treatment exists, the EPA and State believe that no treatment system will achieve cleanup levels in ground water any faster than natural attenuation. The EPA and the State also believe that any treatment system may also generate hazardous residues that will require management and off-site disposal. Therefore the only remaining criteria to evaluate was cost. The community, as evidenced by Town representatives and officials, believe natural attenuation to provide a better remedy than pump and treat because it will preclude intensified traffic and the generation of potentially hazardous materials.

E. The Selected Remedy Satisfies the Preference for Treatment Which Permanently and Significantly reduces the Toxicity, Mobility or Volume of the Hazardous Substances as a Principal Element

The Limited Action alternative, due to the cap installed over the landfills, will reduce mobility and toxicity by lessening infiltration and contact with ground water lessening the amount of arsenic mobilized.

As cited earlier, it is believed that no treatment system will achieve cleanup levels any faster than natural attenuation. A ground water remedy in this area would need to pump and treat a significant volume of water and yet would not achieve cleanup levels any faster than natural attenuation. A pump and treat remedy may generate hazardous residues and will increase truck traffic.

A pump and treat system may arrest migration; however, it is believed that such reductions would be localized and that contaminant concentrations would rebound once pumping is ceased if contaminants are still leaching from the landfill.

Volume would not be reduced under the Limited Action alternative. Now that the disposal areas are capped, the slow leaching of contaminants from the landfill will diminish and ultimately cease. The same volume of arsenic would exist in the subsurface; however, once contaminants diminish or cease flowing from the landfill the conditions in the aquifer concentrations in the ground water will also diminish.

XII. DOCUMENTATION OF NO SIGNIFICANT CHANGES

EPA presented a proposed plan with a preferred alternative for remediation of the Site on April 24, 1996. The preferred alternative included:

restoration of ground water through natural attenuation;

sampling of ground water, surface water, and sediments;

establishing institutional controls to prevent the consumption of contaminated ground water; and

investigate and act on any indications that ground water contamination is worsening or impacting surface waters.

This amended Record of Decision contains all of those components and remains substantially unchanged from the presentation given in the Proposed Plan. Some concern existed over arsenic-contaminated sediments in Cohas Brook due to data collected in 1995 that showed localized high concentrations. The EPA and a group of the PRPs sampled this area and found that it did not pose a threat to human health and the environment. The results of this investigation are presented in Appendix D.

XIII. STATE ROLE

The New Hampshire Department of Environmental Services has reviewed the various alternatives and has indicated its support for the selected remedy. The State has also reviewed the Remedial Investigation, Risk Assessment and Feasibility Study to determine if the selected remedy is in compliance with applicable or relevant and appropriate State Environmental laws and regulations. The State of New Hampshire concurs with the selected remedy for the Auburn Road Landfill Site. A copy of the declaration of concurrence is attached as Appendix A .